CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

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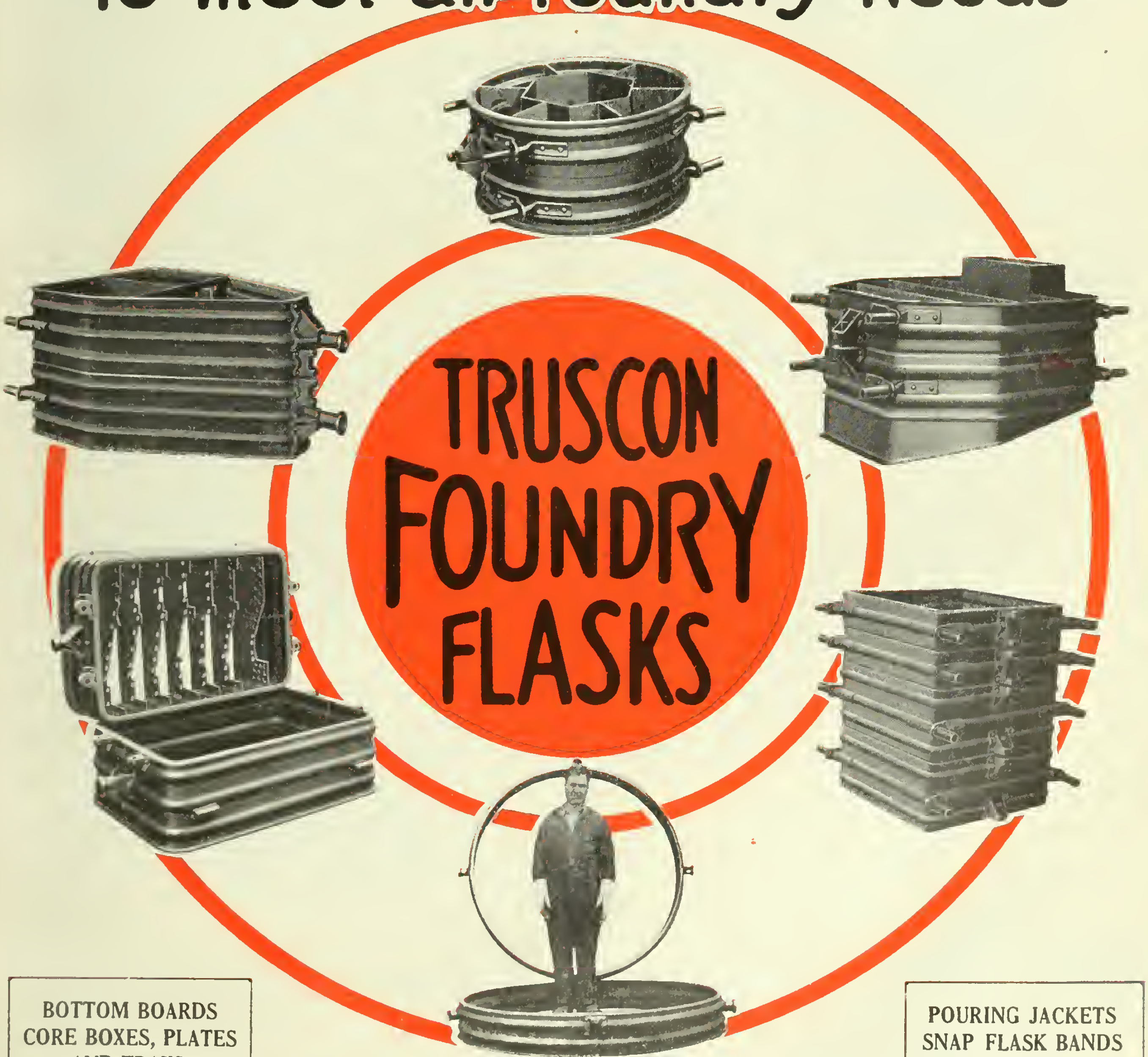

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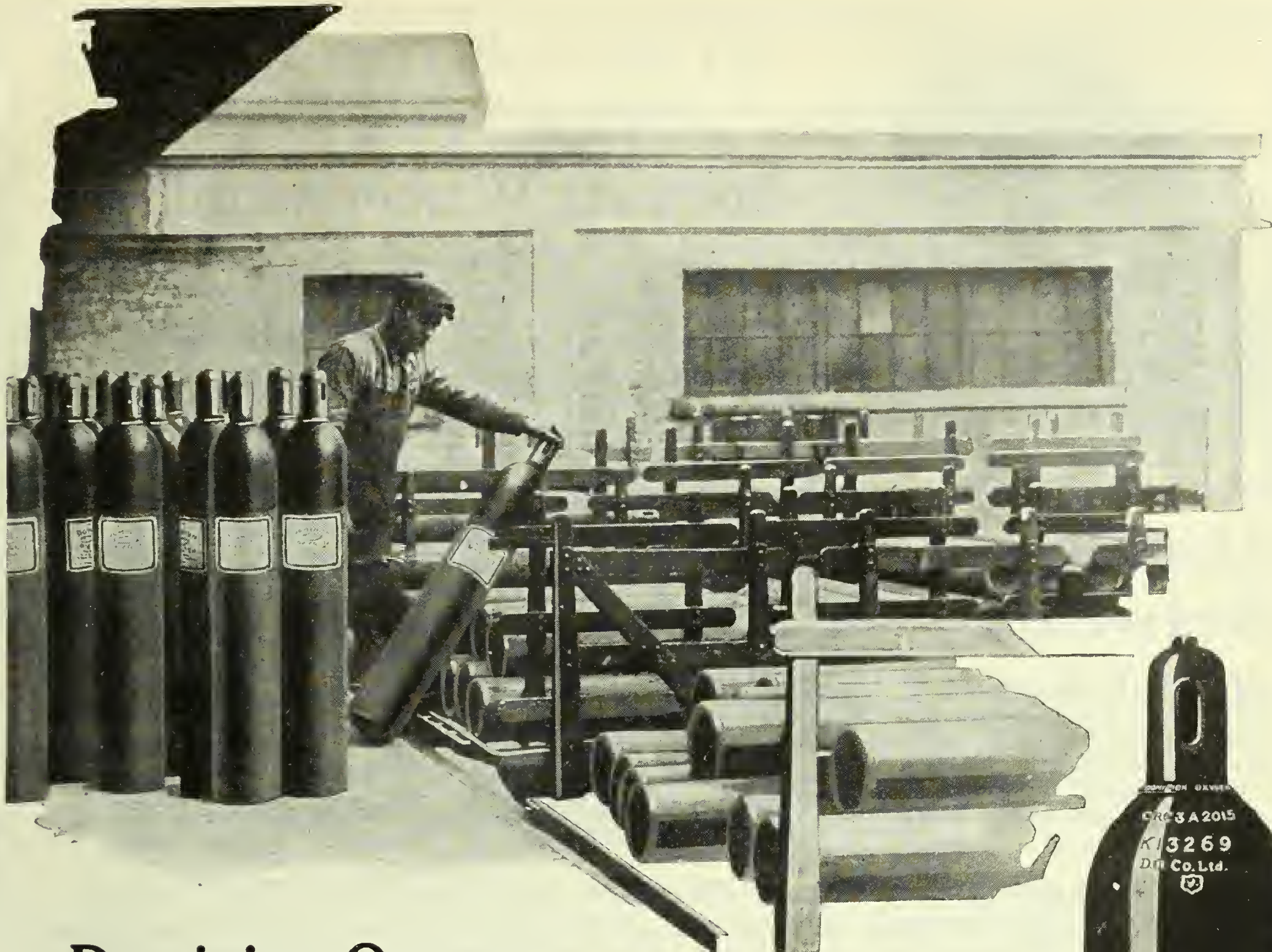

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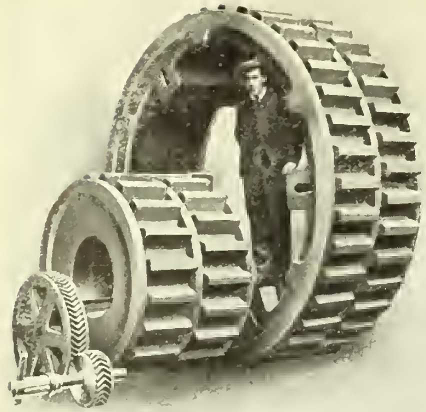

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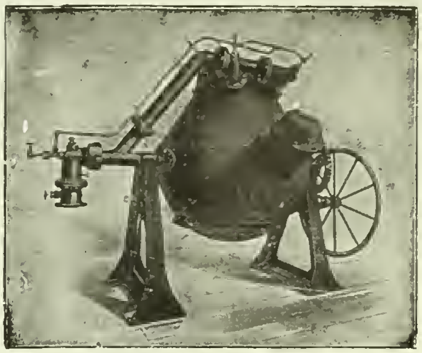

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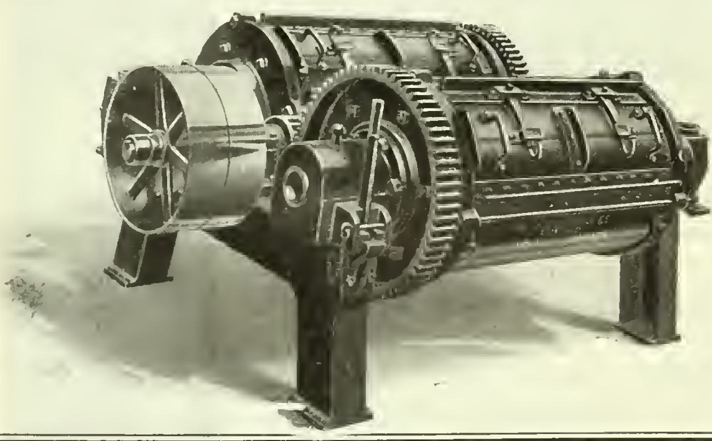

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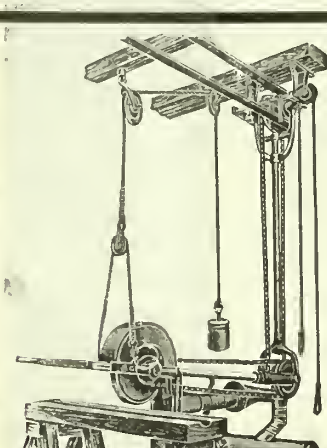

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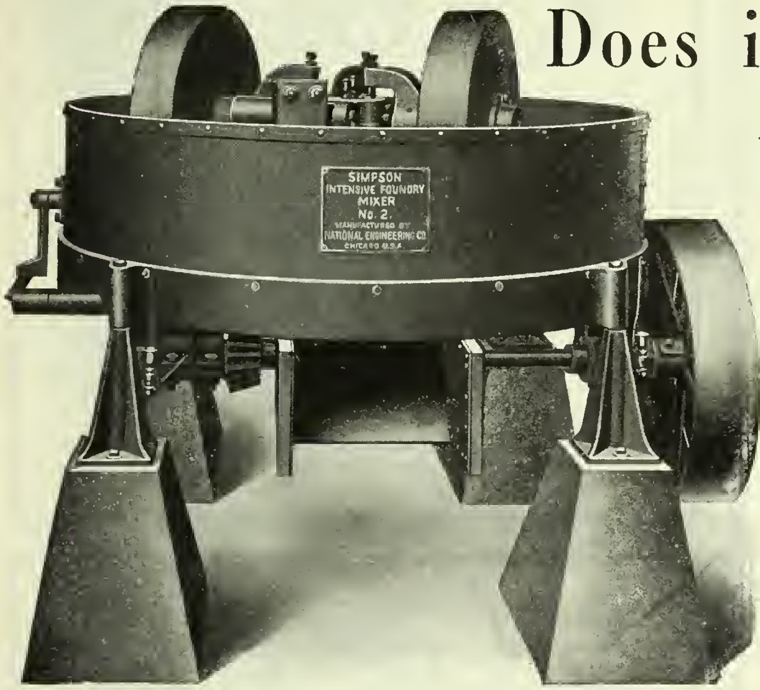

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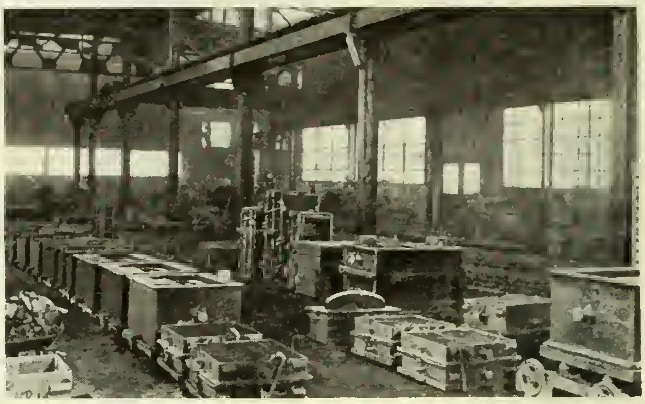

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

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Two Divergent Types of Modern Iron Foundry

Plants Are Built and Equipped for the Line Intended to Be Manufactured—Metal, Sand, etc., Suited to Heavy Work Is Not Adaptable to Light Castings, and Vice Versa

By F. H. BELL

IN OCTOBER I showed a few of Canada's foundries which have been in operation for some time, in order to let those who have been careless about such matters know that we had such institutions in this country. Some of these foundries have been in continuous operation since the early part of the last century while others were built quite recently, but all were kept up-to-date by constant attention to the installation of new equipment.

My object in publishing the history of these few plants was not to boost them or cause jealousy between their managers and those of the many other equally as important ones, but just simply to enlighten a certain class of citizen on what we are doing in this big Canada of ours.

Perhaps we have a few historic characteristics which are worth forgetting such as our years of contentment with any old thing in the way of foundry buildings and equipment, but those days are gone, never to return, and Canada is now becoming a nation to be reckoned with. In certain lines we will make no attempt to be leaders for some years to come, but in many lines which require the services of the foundry there is nothing to prevent us from keeping pace with the rest of the world.

In spite of the quietness of the times new foundries are continually springing into existence, which fact would certainly look like a demonstration of the confidence in which Canada's future is held.

The type of foundry which is being built also carries a certain amount of significance. The general-purpose type of foundry which must always be with us is being mostly confined to the smaller ones, while the larger plants if not in any special line, hold pretty close to a special class of work, or in other words the foundryman who is making big castings in a jobbing foundry equips for doing big work and caters to that class of work, even to the extent of not seeking small work, while the man who caters to the small casting business supplies himelf with iron and sand, suitable for light work, and equips his foundry with machinery on purpose for this kind of work.

The last ten years have seen more real progress in this line, many times over, than any decade in our history, in spite of the fact that included in these ten years we experienced four years of war which put a damper on foundry business for quite a while. The first two years of the war brought foundry work to practically a standstill, but this, while seemingly a hardship for the foundryman, was undoubtedly what gave him the incentive to investigate possible avenues through which to operate profitably under changed conditions, and as a result some foundries of exceptional merit have been erected during the last five years and many of the older ones have been remodeled and re-equipped. Our laws have been so revised as to require owners of foundries to provide their employees with suitable washrooms so that they may attire themselves in dry underclothing before leaving at the end of the day's work. Many employers have gone far beyond the requirement in this direction, and have put in lockers and many other up-to-date conveniences.

In the present article I want to show two foundries which have just nicely got under way and which are in lines such as I have just spoken of. Both of these plants are connected with machine shops where a regular line of its own work is carried on, but since a comparat-

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ively small foundry will supply all castings required in a fairly large machine shop, and since equipment required in a small foundry will be standing idle too much of the time to be profitable, it was considered advisable to build the foundries big enough to keep all the units of equipment in constant use.

The one which I will describe first is located in Brantford, Ont., and is doing heavy work principally, but is also equipped to do medium-sized work calling for special metal. This company operated their machine shop for a short time prior to building the foundry and during this time they worked up a good trade and at the same time found out from experience just what they required in the way of a foundry, and when they built, they built what they wanted. The company to which I am alluding is the Dominion Steel Products Company, Limited Brantford, Ont., and as their name implies they were organized to manufacture steel products, which they continue to do, but much of their work calls for cast iron, and some of this must be of special analysis which it is not always handy to secure from an outside concern, hence the building of their own foundry.

The other foundry to which I am referring is located at Bowmanville, Ont., and is in a line far remote from the one just described. In this shop, nothing but the softest of iron can be used, and nothing but fine smooth sand will answer the purpose, which is that of producing fine, light, soft castings; this being the specialty here.

Both of these foundries will be described in a brief way, and while these are only two of the many modern shops which are springing up in different parts of the country they show the two extremes of perfection to which the foundry business is being carried, demonstrating that if the foundry was slow in modernizing it is progressing favorably of late, and Canada being among the latest additions to the list of manufacturing nations, is building the latest type of foundry.

Dominion Steel Products Co.'s New Foundry

Large Cranes and Cupolas, Twenty-Ton Air Furnace, Continuous Core Drying Oven, Heavy and Light Molding Machines—Everything Modern

The Dominion Steel Products Company, Limited, Brantford, Ontario, decided in 1919, to erect a modern foundry to enable them to provide castings suitable for the special products manufactured by them.

The foundry is 100 feet x 160 feet and the interior layout consists of: One large main bay 50 feet wide by 160 feet long with side bay 25 feet wide running the full length of the foundry.

The foundry is exceptionally well equipped to make heavy work; mill and machinery castings, mill rolls, chilled rams and heavy long plungers being a specialty. For this purpose a concrete casting pit was installed in the main bay, being 8 feet wide by 16 feet long and 15 feet deep. This allows castings thirty feet in length to be cast on end. There are two Sheldon continuous tuyere cupolas, one 44 inches in diameter and the other 72 inches in diameter, which are used to take care of the ordinary light and heavy castings, but the most noticeable feature of the melting equipment is a 20-ton Pittsburg Type Air Furnace, which is probably the only one of its kind in Canada. It is used to produce cast iron of exceptionally fine quality and strength and to produce castings in this country which have heretofore been imported from other countries, such as chilled and sand rolls, close grained rams, large engine castings and mill castings of special strength, caustic pots, and all kinds of iron castings where quality and exact analysis is of the utmost importance. This furnace has already been tried out on many of the above products and has proven satisfactory in every particular.

The main aisle is also equipped with One Herman 40 inch x 60 inch roll-over molding machine of the most modern type. The main bay is also served by one 25-ton crane.

The side bay is served by a small electric crane and is equipped with one small Osborne molding machine, which takes care of the small castings.

In the bay on the other side of the foundry is located the air furnace, the cupolas, the blower room, the core room and the continuous core drying ovens. Above this and forming a charging floor for the cupolas is a mezzanine floor is located the brass foundry which is equipped with a Bailey electric furnace of 50 k.w. capacity, which melts the metal by radiating heat only. As there is no arc used in this type of furnace the results are metals of very fine quality and it is possible to produce all kinds of non-ferrous alloys without difficulty.

The cut showing the brass foundry also shows the molds for some bushings of phosphorus bronze which weigh 500 pounds each.

In connection with other products manufactured a large quantity of manganese bronze has been produced from this furnace which shows a tensile strength of 60,000 lbs. to 70,000 lbs. and 30 to 40% elongation. This metal is used principally for valves, fire hydrants, etc., but is exceptionally good for bronze gears where strength and wearing quality is required as it shows the same strength as ordinary steel forgings. The brass foundry is also equipped with an oil crucible furnace capable of melting 200 pounds per heat.

One end extending across the whole foundry is used as the cleaning floor. This is equipped with the most modern air tools, also one large rotary sand blasting machine and two dustless tumbling barrels of the most modern type.

The foundry stock of pig iron, coke, etc., is stored in a yard which is served by a 10 ton crane of 81 ft. 6in. span. The yard is also equipped with a concrete breaking pit.

The foundry is in charge of Mr. James F. Brown, who has had over twenty-five years' experience in some of

Interior View of Foundry, Dominion Steel Products Co.

Twenty-ton ladle, receiving metal from air furnace, Dominion Steel Products Company, Brantford, Ont.

the largest and most important foundries of the United States, to which he came direct from England, where his early training and experience qualified him for these highly important positions.

He was superintendent of the steel, iron and roll foundries of the Mesta Machine Company of Pittsburg for ten years, following this he was superintendent of the Morgan Engineering Company's foundries located at Alliance, Ohio, for eleven years, coming direct from there to the Dominion Steel Products Company, Limited, Brantford, Ontario in 1919 where he acted as superintendent of construction until completion of the foundry, remaining afterwards to take charge of same.

Brass foundry department, Dominion Steel Products Company, Brantford, Ont. Note electric furnace and molds for heavy bronze castings.

From what we have shown it will be seen that this concern while to some extent a jobbing foundry is a specialty shop, in that they specialize on a line of work which is in a class by itself.

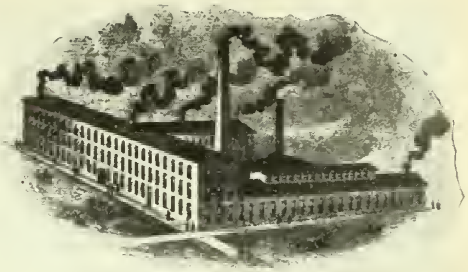
Light Casting Foundry at Bowmanville

Especially Built for Doing Light Work, the Equipment Is of the Light-Work Variety

The Bowmanville Foundry Company have equally as complete a foundry as the one just described but for an entirely different line of work. Here the castings are all small, such as the trinkets on a stove, which are are too risky for even the stove manufacturer to make in his own foundry, piano trimmings, paper-dealers' hardware and sundry articles of this type.

While this is jobbing work covering a big variety of lines it is in reality only one special line as far as the foundry is concernerd. The metal used in this class of work requires, above all things to be soft—that is the kind of soft which will remain soft even though chilled. Some iron is soft if poured into chunky castings, but if poured into work which is light and sets as soon as poured, it will be hard. This class of iron will not answer the purpose, but in its place an iron which would not do so well in heavy work is necessary. To get a good iron for small light work is more of a chore than for ordinary castings. To arrive at an analysis which will remain soft in thin castings and at the same time show all the fine details of the mold requires careful study. Both silicon and phosphorus are hardeners unless used exactly as they should be and these two metalloids are both taken advantage of in light work.

Sand also is of first importance. The sand used on fine work requires to be fine grained and with a good bond so that is can be converted into molds without hard ramming. All these features, while differing radically from what are called for in heavy-work foundries are equally as important in a successfully operated foundry. In the small view will be seen the plant of the Bowmanville Foundry Co. as it appeared a year ago. This is typical of the ordinary iron works as it used to be, but this is not up to date. The idea of a big machine shop facing the street and the foundry somewhere in the back yard is not modern practice. This plant has been sold to a knitting company and is probably ideal for this purpose. The new plant which the company recently moved into consists of a machine shop, plating and polishing department, electric welding dept. and all the other departments arranged for convenience and then as an individual unit there is a modern foundry built almost entirely of glass, with a floor space of thirteen thousand square feet, a section of which is shown in the illustration. Every modern device is utilized, but in this class of work the only molding machine which is of use is the squeezer. The Farewell type of squeezer is used exclusively in this plant. The Roots blower is seen beside the cupola on the floor where the heaviest and purest air is to be found. In connection with the foundry is a fire-proof pattern vault and weather proof sand storage, making the foundry thoroughly up-to-date for the line of work followed.



Discarded plant of Bowmanville Foundry Co.

Interior view, Bowmanville Foundry Co.

Molding a Propeller Screw Wheel in Loam

Primitive Method Has Some Advantages Over Modern Molding—No Pattern Is Used but Pattern-maker's Skill Is Required

By F. H. BELL

The subject of loam molding is one which interests every molder, but is, at the same time, understood by few. It is undoubtedly the oldest branch of the molder's art, but this, of course, does not add to its value. It has been outclassed in many ways by more modern methods of molding for the general run of work. But loam molding has its advantages in some cases and could be used to exceptional advantage in the most modern foundries, if more of the modern molders understood it, but even the material from which loam is made is to a great extent misunderstood by many foundrymen who are good loam molders. In practice, loam has always been a brand of molding sand exceptionally rich in clay, and applied in an exceptionally wet condition. If a sand of the proper clay proportion is not available, clay is added, and when a properly proportioned mixture is thoroughly dried onto a good substantial brick backing it will stand the heat and pressure of the heaviest casting, while also being a convenient material from which to make the mold. The one draw-back would be that the metal would not lie on it as there would be no escape for the gases which would be generated. To overcome this an opener of some kind was mixed through to give it vent. This opener might be saw-dust or straw, but quite frequently horse manure, any of which would burn out in the drying and leave the mold as substantial and refractory as before while being porous like a very fine sponge. This is still the practice on some classes of work but is not of any great importance on others, as an ordinary core sand mixture works all right in some plain work, while molding sand mixed with black core binder will work on quite complicated jobs. Millville gravel, a natural product, is a good mixture for the heaviest class of work. Whatever composition is used, the molder should use judgment and see that no part of the mold is allowed to be passed over without care being taken to see that the gas is going to escape and if a pocket cannot be vented by other means a special mixture with an opener in it is preferable to a defective casting.

One feature which was formerly of big consideration, is now less essential, viz., the fact that a very large job could be done without a large crane or oven, as the mold could be built and dried right in its place and if necessary poured direct from the cupola. With the advent of the powerful electric crane, almost any piece can be made in a sand mold, and dried in the oven which usually accompanies such a crane. There are, however, cases where loam molds of large proportions can be made and lifted into the oven, to better advantage than by attempting a sand mold.

Mold a Propeller in Loam

In last month's paper we showed how propellers were made from a single-blade pattern in a dry sand mold, which method is most successful, but not always possible or advisable. In a properly equipped loam-molding foundry good headway can be made in loam molds and first-class work result. In Great Britain this is still the practice in the best foundries and a description of how it is done will be of interest.

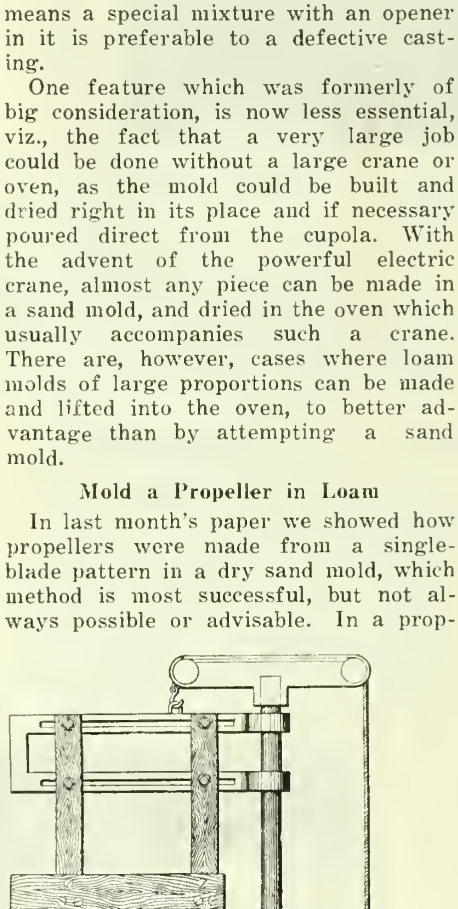


Fig. 1

In our last article we pointed out that the pattern-maker was of prime importance. In the loam-molding process he is of even more importance, although no pattern is used, but the pattern-maker is the man who must provide the strickles and other necessary rigging which looks simple to the molder when handed to him but which represent a lot of calculating on the part of the pattern-maker. Even in the loam process there are different ways of proceeding—some more efficient than others.

Presuming that we have no equipment and only intend to do a moderate amount of business the method adopted by Simpson Bollard is about as complete as any and will require the minimum of expense in making preparations. Mr. Bollard in his illustrations shows a three-bladed propeller, although four blades make the recognized standard wheel, but as far as the molding goes one is as good as the other.

To Make a Ten-Foot Wheel

Let the foundation-plate A, Fig. 1, be 12 feet in diameter, resting on firm ground, and begin by striking the bearings B and C, Fig. 1.

The sweep for striking these bearings will bring the bottom of the hub high enough to allow the blades to be built. As the hub in this case is about twenty-four inches in diameter, a wooden pattern would be an expensive affair, and to overcome it there are two ways open to the molder to form the hub. One is to work a sweep against the spindle as the blades are being built; the other is to build a dummy pattern on bearing C, as shown at D, Fig. 1, before commencing to build the blades. We will adopt the latter. Now let a line be drawn all round the outside, as seen at E and divided according to the number of blades, which in this case is three. The inclined frame F is now set to the line E, with center-line at line H on bearing B.

In order that the beginner will better understand what he is working at we will refer to Fig. 2, which is a perfect view of the blades as they will appear when built, and he will be in better shape to understand the various in-

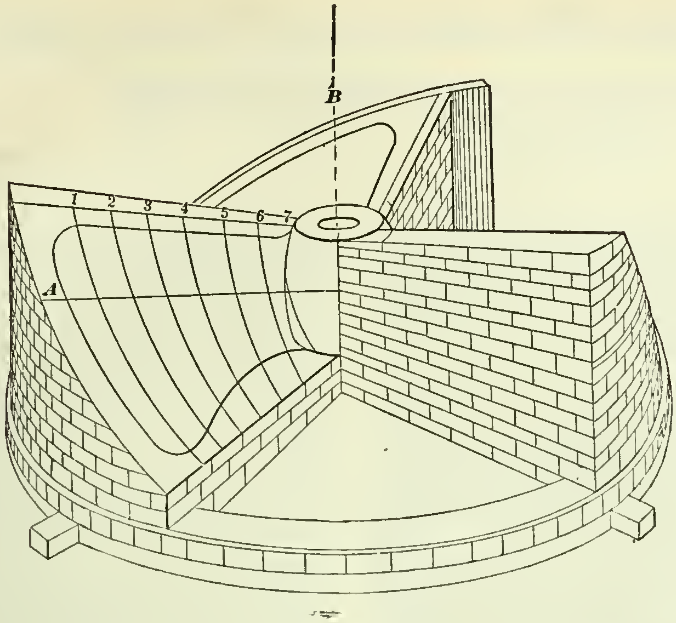


Fig. 2

structions he is called upon to follow. The inclined frame F, which is the guide for the sweep, and which might appear to be one of the difficult propositions for the pattern-maker to lay out is in reality very simple. It would be laid out flat to begin with, and a straight line drawn diagonally across it at whatever angle is required for the proper pitch of the blade. It is afterwards sprung into the proper curve to fit the portion of circle as shown. A triangular piece of boiler plate is frequently used, being run through the rolls until it fits the circle. As the sweep must travel up and down the inclined guide F to give the required pitch to the blade, the arms must work free on the spindle, rising and falling as needed. To accomplish this, a method is shown at Fig. 1 which is simply a cross-beam, with socket to fit the top of the spindle, and with a pulley at each end, over which a rope travels with a counter-weight at the back to balance the sweep board. The sweep is plain, and must be set in line with center of spindle.

The first process is to brick high enough for thickness of blade, and to do this a guide piece I is screwed to the bottom of the sweep, this being the true section of blade from hub to outside. The reader will understand from this that the flat or true face of the propeller, which is, in fact, the working face is to be cast uppermost in the mold. This may not always be advisable, but will be described first, as it is sometimes the most advantageous way, according to the design of the wheel. When all the piers are built to this shape, remove the piece I, but leave the sweep in its exact position in regard to height and build up the brick work beyond the diameter of the proposed blades until it reaches the sweep board, and filling in the space formed by the piece I with loam or any substance which will hold its shape and form the face of the blade when swept with the straight sweep board. This will not, in reality, be the face on which the cope will be built, but it will form the face on which the blades will be laid out. As soon as all the blades are swept true to the inclined frame and allowed to set enough to hold their shape the sweep is brought down to the line G on the inclined frame and a line marked across from G to the hub. This line in the center of the blade. Fig. 2 is a perspective view of the mold at this stage, with the three blades built and this center line drawn, the lines being shown at A and B. The lines 1, 2, 3, 4, 5, 6, 7, Fig. 2, are scribed down with the sweep, and are an equal division of section of blade, as shown at Fig. 3. From the center-line A, Fig. 2 is marked off on either side the width of the blade. A paper pattern of proper

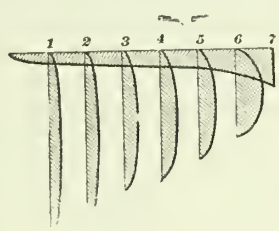


Fig. 3

shape for blade is as good as any to get the outline of the blade. The filling material is now removed to the shape of the outline, and the marks 1, 2, 3, etc., which project beyond the outline, will show where the sections Fig. 3 are to be placed. These sections will rest on the original surface swept by the piece I, which surface and the outline would have made the blade complete, were the blade to be the same thickness right across. This not being the case, these forms, which are the proper depth at the deepest part to bring the top in line with the swept joint or upper surface are put in position and secured; loam is tucked under them forming a portion of the blade of proper shape. These portions after becoming set and the forms removed make guides from which to sweep with a short piece, the proper shape of blade. Green sand is now rammed in good and hard, and struck off smooth with the sweep. This may be dried or it can be used as it is, with care.

The bottom half of the mold is now complete, and it only remains to have copes over the blades and a top for the hub. There are different ways of making the copes, but as we are following the least expensive method of getting equipped, a frame with slats to hold the bricks together is what would most likely be adopted, but if business possibilities warrant, grids made to fit the twist represent a more advanced idea.

Complete copes such as were shown in our last article would be all right, in which case, dry sand copes could be put onto the loam bottom. The different methods of making copes together with a more complete article on making the bottom part and also the pattern-maker's share in making the mold without pattern will be described in a future article.

THE "AURORA" OIL FUEL BURNERS FOR FOUNDRIES

Mr. A. H. Wilkie, of 78 Duke Street, Liverpool, England has developed a useful fuel burner of the portable type that is especially designed to be of use in foundry work.

Two types are made, one operating by means of compressed air and the other by means of a hand air pump. The compressed air type has the advantage of instantaneous starting. There is no preheating necessary, and as there is no coil there is never any choking up through carbonization. Any kind of oil fuel can be used.

The burner proves to be particularly economical when used to dry floor moulds. Economy in both fuel and time is realized. The use of the burner to dry steel moulds shows remarkable results. The fuel saving is from 25 per cent. to 50 per cent. and in two hours a mould can be dried that will require twenty-four hours with a coke fire.

For lighting up a cupola it is also used to advantage. A 5 inch steel pipe is placed in the bottom of the cupola and the coke placed on the hearth. The pipe is withdrawn, preferably through the rear opening if one is provided on the cupola. Thus an arch of coke is formed and the burner flame introduced here. The result is the first iron down is clean and hot. There are no ashes in the bottom of the cupola, and no fear of a back draught.

The burner is used to preheat castings for burning or welding, drying ladles and heating steel ladles prior to taking the metal from the convertor or electric furnace. This method of preheating ladles is clean and can be continued up till the moment the ladle is required, thus avoiding the possibility of chilling.

Cores, Core Sand, Core Binders and Core Ovens

Binders to Give Satisfaction Must be Properly Baked—Makeshifts Which Will Pass in Some Cases Can Not Be Tolerated in Others

By F. H. BELL

IN THE last issue of Canadian Foundryman there was published an article on core making which was a well prepared collection of the different features of the core makers' everyday routine, but like many articles on foundry practice it left a lot of valuable points untouched, and these I propose to dwell upon on this occasion.

In all lessons on sand we are taught not to mix two sizes of grains of sand, because the fine grains are simply crowded into the crevices between the coarser grains, thereby closing up the only avenues of escape for the gas which generates when the core comes in contact with the melted iron.

We are also told to buy pure clean sharp sand, preferably pure silica sand, and to avoid all vegetable and animal matter. By this means very little binder will be required and as a consequence very little gas will be formed. Yet we are told that in order to have a core which will hold its shape we should mix molding sand into it.

Now what do we do when we mix molding sand into a batch of core sand? and what is molding sand?

Molding sand is simply sand to which is added about five per cent. of clay and an additional small quantity of iron rust, lime, and alkali, the duty of which is to prevent the mold from being baked into pottery when it comes in contact with the melted iron. Outside of the clay content the other ingredients are lifeless as far as holding the core together is concerned.

Now if we drench the molding sand with water until we wash away the clay and other foreign matter, what do we find? simply sand the same as we are going to mix it into, only on a much smaller scale. The grain of very coarse molding sand is small compared with ordinary sharp sand, so when we mix a barrow of molding sand with half a dozen barrows of sharp sand in addition to the regular core binder, we are simply mixing one barrow of fine sharp sand with six barrows of coarse sharp sand and less than one per cent. of clay, which is equivalent to wetting down with thin clay wash. There is nothing about molding sand to keep the sharp sand in shape excepting the little grains filling up the uneven spaces between the big ones, and the clay holding them there, making the mass somewhat of the constituency of concrete—the very thing we aim to avoid. If to this we add some of the paste binder, such as flour, we have a compact mass which will create abundance of gas but through which nothing will penetrate. A core made of this kind of material cannot be of use for any but the simplest of cores.

If we must use molding sand or in other words clay and fine sand to hold up the coarser grained sharp sand we must have some kind of a binder which will secure them while at the same time leaving porosity through which the gas can escape.

Any kind of pitch, tar or gum will melt and spread while the core is being heated in the oven. Supposing a grain of resin (rosin) is lying beside a grain of sand the heat melts the resin and it runs around the grain of sand and in doing so leaves a certain amount of space where it vacated. This continued all through the core leaves it open enough to allow the gas to escape. Binder containing bolted resin is hard to BEAT for cores which are not going to be exposed to a very heavy volume of metal. For heavy castings a more refractory binder is required, and right here is where some study is required.

If sand is mixed with coal tar it makes a good core which will hold up against very heavy volume of melted iron, but its great disadvantage is that its extreme refractiveness causes it to bake hard into the casting where the work of removing it is greater than that of making the core. This can be easily overcome if a proper understanding of the subject is possessed by the core maker and if he has a suitable core oven.

The Core Oven

The core oven is, not only, one of the most neglected pieces of equipment in the foundry but is as a rule not built on proper lines even when the required funds are available and when the limit of perfection is aimed at. The aim in building a core oven seems to be to so arrange it that the cores will be baked slowly so as to not burn them, but few foundrymen seem to realize that different binders require different treatment, and that for this reason the oven should be so built that it can be heated to any desired temperature. If black dry binder is used, it has practically no adhesive qualities at ordinary oven temperature and for this reason is frequently condemned as unsuitable when in reality the fault was in the oven. There are innumerable lines of core work which can be successfully made from refuse of almost any kind such as gang-way siftings, or burned molding sand, while using black compound as a binder, but such cores are usually a failure for this very simple reason—that the oven was not hot enough to melt the binder.

Black binders are composed of a basis of tar refined to practically a coke and in order that it shall work out satisfactory as a compound it is necessary that it be treated at a much higher temperature than that of the ordinary core oven. It will be readily seen that when this material is mixed in the core sand and dried or baked in an oven heated to a temperature of say 33 degrees the compound is barely fused and in consequence only makes the core sufficiently strong to stand handling of the most careful kind, but when this core is placed in the mold and exposed to a temperature of consideraby more than two thousand degrees which are required to hold the metal in a melted state, it is only then that we obtain the full strength of the binder. In consequence the core becomes so hard that it is very difficult to remove it from the casting. Obviously if the oven had been heated to a temperature approximating two thousand degrees the core would have been more easily handled and would also be in good condition to burn out when exposed to the melted metal.

My point is that the oven should have a good big high chimney and have direct draft and then have different check dampers so that the temperature can be held at any desired degree. It is not necessary to have it up to two thousand but it can be away up above what is usually the rule. If an oven of this style is at the disposal of the coremaker, the core sand need have only about one third of the usual amount of binder, and when the cores come out of the oven they will be hard enough to handle without pulling to pieces in the hand, and then when the melted iron is brought to bear upon them they will burn out and be easily removed. This kind of binder is not suitable for small intricate cores, but it is alright for plain cores which are to be used in heavy castings. It is not necessary to use old sand, but this is one of its good qualities—if properly used it makes a cheap binder.

If cores such as we were referring to in the beginning of my article and which are liable to sag are to be made, it is quite possible to build up the mixture with new molding sand or clay, and the binder will prevent it from becoming dense. Certain it is that if a binder is used there will be gas, and this gas must escape. Vent holes are simply like trunk sewers, to carry away the gas, but the sand itself must be porous enough to allow the gas from each grain to get to these trunk sewers.

In case of burn or scald, cover the affected part with cooking soda and lay wet cloths over it. Whites of eggs and olive oil are also good. Other remedies are:—olive oil or linseed oil, plain or mixed with chalk or whiting, olve oil and lime-water.

Some of the Potentialities of Rustless Iron

A Metal Which Overcomes Many Disadvantages of Stainless Steel, Is of Superior Strength to Brass, and Is Easily Kept Clean and Bright

From the Foundry Trade Journal of London, England, we take the following, which, while not being as yet a foundry success, is nevertheless a foundry proposition. If this class of metal can be produced in the forge shop it must be produced in the foundry, and it is up to some smart foundryman to devise means of successfully pouring rustless iron castings.—Ed.

Rustless iron must not be confused with stainless steel, as its properties and industrial applications differ considerably.

Stainless steel is now universally known and recognized in its application to the cutlery industry, and also in a much smaller degree to the engineering trades—valves, pump rods, spindles, turbine blades and numerous other articles now being manufactured. It is somewhat limited in its sphere of usefulness on account of difficulties met with in forging and working due to its nature. It requires constant heat treatment, and must finally be tempered, and then polished to render it stainless.

Rustless iron is a further development, being discovered about the beginning of the war, which interfered with its expansion. It does not require heat treatment after it is made into the ingot, and is exceedingly ductile in working up into manufactured articles.

Its commercial practicability having been now fully established, stainless metallurgy has now become an absorbing topic among steel manufacturers. Considerable experimenting has been, and is being, undertaken, with the result that a point has now been reached which increases its sphere of usefulness to an almost incredible extent. The newer material is really a dead soft steel, from which the carbon has been practically eliminated, and which, for classification purposes, has come to be known as "Rustless Iron," to distinguish it from its harder relation, "Stainless Steel."

Both these steels represent a new chapter in the romance of Sheffield's industry, and are now considered to be more important than the advent of tungsten high-speed steels.

Rustless iron presents a number of initial difficulties, the elimination of carbon being one, and its manufacture is one calling for minute care and attention in all stages. Careful supervision of the raw materials, and also in the melting, in order to keep down the carbon content, means high-class laboratories and skilled chemists.

It is being made in crucible pots, both choke-fired and gas-fired, but the electric furnace method is by far the most satisfactory for controlling the carbon content, and at the same time keeping costs within commercial bounds.

The usual process is to melt the steel scrap, decarbonise, and then add carbon-free ferro-chrome. Owing to reactions which take place, it is very difficult to eliminate carbon after the chrome is added.

It is, however, being made direct from chrome ore in the electric furnace, by a combination of "Thermit" reaction, supplemented by electrical energy. Comparative physical tests are stated to favour the use of carbon-free ferro-chrome.

Rustless iron contains 10-12 per cent. chromium and a carbon under 0.1 per cent. maximum, with the balance as nearly as possible pure iron. Stainless steel contains about 14 per cent. chromium, and a cheaper grade of ferro-chrome can be used. The former, however, compares very favourably in price with the finished sheet or bar through lower working costs after casting. Easier working and the dispensing of heating costs should make rustless iron a strong competitor of brass and aluminum, when due regard is taken of its rust-resisting properties when exposed to ordinary atmospheric conditions, and its subsequent labour-saving qualities, especially in articles of domestic utility. A damp cloth wiped over any article made of rustless iron will remove any dirt which may have settled on it, and leave a perfectly clear surface. There is no necessity to lacquer as in brass and nickel-plate, or galvanize as in mild steel, and therefore such expenses are eliminated.

With regard to its physical side, rustless iron is at least twice as strong as brass, and much tougher than common iron, and much can be done, therefore, to cut costs in weight saving in the manufactured article. It has a tensile strength of 30 to 40 tons per square inch, and even higher with special treatment, and yet can easily be stamped, pressed, rolled or drawn in a cold state. It can also be soldered, brazed or electrically welded, and machines easily. It can be chased or engraved as well as burnished equal to plate.

So far as present prices are concerned, rustless iron is more expensive than brass, and a little higher than aluminum sheet, but if produced in bulk should compare more than favourably with such materials, in addition to its special properties.

When one comes to consider its uses, it is difficult to know where to begin, as the naming of one article immediately suggests a dozen others. Anything made from brass, sheet, rod or tube can be made from rustless iron, and articles of domestic utility present a wide field. The stove grate industry, cooking ranges, cabinet fittings, railway carriage and tram fittings, the motor trade, refrigerating plant, ship work, etc., can all absorb huge quantities.

Sheffield manufacturers are preparing for big developments, and it is now possible to obtain sheet, rods, wire and tubes in rustless iron quickly. At present castings cannot be made, as the metal is very sluggish in pouring, even with a high temperature.

BRITISH INDUSTRIES FAIR, FEB. AND MARCH NEXT

The eighth annual British Industries Fair which embraces a large number of the most important lines of British trade will be held in London and Birmingham from 27th February to 10 March. This is purely a trade fair where buyer and seller meet, not an exhibition. This Fair, whether regarded from the point of view of size, diversity of products shown or resultant business, now surpasses in importance and value to the world's markets any other trade fair or similar purpose. A visit to the Fair will convince overseas buyers that enormous strides have been made in Britain's post-war production. A considerable number of Canadian buyers are making arrangements to attend. Admittance is restricted to trade buyers on invitation of the British Government and business is not impeded by crowds of sightseers.

The exhibits will all be from firms within the empire but others will be there as purchasers. Every convenience in the way of information bureaus, reading and writing rooms will be provided. Each section of the fair will be under one roof but the various trades are grouped in separate compartments. Practically every imaginable line will be represented, but the Birmingham section will probably be of most interest to those in the metal industry business.

The British Trade Commissioners in Canada will be pleased to give full particulars and to issue invitation cards to Canadian buyers who propose to visit the Fair, at their following addresses:

248 St. James Street, Montreal.

260 Confederation Life Building, Toronto.

610 Electric Railway Chambers, Winnipeg.

The crystals of hoar frost resemble those of snow because they consist of similar atoms crystallized under somewhat similar causes.

PATTERNMAKING

Some opinions concerning the Patternmaker and his art

Selected by W. P. ESSEX.

Jot It Down

(1). It has been our hobby when reading to jot down any item of particular interest, which we come across relating to our craft, or the work which is part of our daily life, in which our interest lags.—Recommended.

Patterns, A Simile

(2). We seldom stop to think of it, yet it is a fact that life is a mimeograph. Just as one makes many copies of the same letter by cutting a stencil and duplicating from this pattern, so we all are making copies of the actions and words of other people. Similarly, they also are copying our deeds and word. Any mistake that one makes in the original pattern always is followed more or less exactly, or made worse, in every copy made from it; and it is so in life.

Every mistake of ours that comes to the notice of other people is certain to be duplicated or even made worse by some one else. It is a great responsibility we have when we cut our patterns for the mimeograph of life, yet we cannot avoid cutting one or many daily. If we could avoid spoiling the life records of other people, then, we must be careful every day to avoid putting mistakes into our own work and lives.—Selected.

The Antiquity of Patternmaking

(3). Pattern-making is of very high antiquity, since some Neolithic fellow-craftsman must have modeled the pattern of the metal mould, with its gate and runner, from which the first bronze user made his first hatchet or chisel of metal. And it can never be superseded, since no machine can ever take the place of intelligence in the construction of patterns whose types and dimensions are seldom exactly alike.—Joseph G. Horner.

A General "All-round" Man

(4). The old race of millwrights were "all-round" men in the engineering firms. They could fit up a mill throughout, design its arrangements, both general and in detail, make the patterns of the cast iron work, gear the mortise wheels, chip and file the iron-tooth ones, weld a shaft, turn it in the lathe, forge levers, fit up the pedestals and bearings, line the shafting, and, in fact, do all the work that is now divided among half-a-dozen separate and distinct trades.—Joseph G. Horner.

Developed in the Pattern Shop

(5). It is in the pattern shop that the engineer and draftsman first see the actual thing which they have designed. Many views and sections may be given, but there still remain points which have to be left to the judgment of the patternmaker, such as the development of curves, rounded edges, fillets and beads, all of which go to make the symmetry of the whole.—R. Watson (Eng.).

A Woodworker of More Than Ordinary Skill and Ability

(6). The patternmaker is usually a woodworker of highly developed skill, who can read drawings and who has an intimate knowledge of molding methods and the materials used in making molds. His work consists largely of making joints, turning circular forms, and building up the patterns to the required shape and dimensions. He should combine the skill of the cabinet maker with that of the wood turner and carver.—J. A. S.

A Skilful Woodworker Trained to Do Accurate Work

(7). The methods used by a patternmaker do not differ materially from those employed by other woodworkers, except that the patternmaker is trained to do more accurate work and, in general, is more skilful.—J. A. S.

Patterns are Subject to Rough Treatment

(8). The patternmaker should keep continually in mind the fact that the pattern of the article he is making will not be handled as carefully when it has left his hands, by the molder, and in its construction he should plan to make it of sufficient strength to withstand the rough foundry usage.—From Experience.

Some Things About Patterns They Both Know

(9). Every molder knows that one of the most prolific causes of ragged molds from split wood patterns is the back draft resulting from the breaking and wearing away of the edges of the pattern adjacent to the joint. And every patternmaker knows that these edges are first water-soaked by the molder's sponge and then broken by kicking around the sand pile. Patternmakers know, too, that no matter where rapping plates and draw plates are placed, the molder will find it necessary to drive his spike elsewhere.—N. O. Giele.

Prefers Patternmaking to Any Other Trade

(10). I have ever loved the trade of my choice. I prefer it to any other with which I am acquainted, and I like it mainly because of the variety of employment which it affords, embracing as it does the whole range of the engineer's knowledge, designing, molding, fitting, and the application of many branches of science besides.—J. G. Horner.

A Working Knowledge of the Other Trades Necessary

(11). It is required of the patternmaker that his skill shall extend beyond a mere ability to fashion wood into a model of a machine part: he must make the model so that it conforms as nearly as possible to the requirements of the foundry and machine shop.—M. M.

A Trade of Class and Distinction

(12). Patternmaking having class and distinction is placed where it belongs in the line of mechanical trades, near the head, and is one line of wood manufacturing where the innovation of machinery has not lessened the demands for patternmakers with brains and originality.—G. F. Reinhard.

Tools and Materials

(13). Though there are many points of similarity among those trades which employ the same materials of construction, each has, nevertheless, its own specialities—special tools, modifications of tools and modified methods of working. Cabinet-making, carpentry, patternmaking, and the cognate wood trades have many tools in common, yet each has also its appliances separate and distinct from the others.—Horner.

A New and Distinct Craft

(14). Although patternmaking is a new and distinct craft, and as such has existed but a few years, patterns have been made for centuries.

How Should the Pattern be Molded?

(15). The first thing that a patternmaker must decide when a pattern is to be made is the method of molding. He should be able to imagine the pattern which he is to make imbedded in the sand, and then decide how this molder can best remove this pattern and its various parts from the sand bed without damaging the mold.—J. A. S.

This Is Also True of Patternmaking

(16). That the older a man gets, the less he knows he knows.

Making Patterns for Gearing—Rudiments

The Principles on Which Gearing Works, Are Shown Before Going Into the Actual Pattern Making

IF WE conceive the pitch of a pair of gears to be made the smallest possible, we ultimately come to the conception of teeth that are merely lines upon the original pitch surface. These lines are called elements of the teeth. Gears may be classified with reference to the elements of their teeth, and also with reference to the relative position of their axes or shafts. In most gears the elements of teeth are either straight lines or helices (screw-like lines). It will be remembered that there are three kinds of gears to be treated upon. First—Spur gears; thos connecting parallel shafts and whose tooth elements are straight.

Second—Bevel gears; whose connecting shafts whose axes meet when sufficiently prolonged, and the elements of whose teeth are straight lines. In bevel gears the surfaces that touch each other, without slipping, are upon cones or parts of cones whose apexes are at the same point where axes of shafts meet.

Third—Screw or worm gears; those connecting shafts that are not parallel and do not meet, and the elements of whose teeth are helical or screw-like.

Arriving at Size of Blank

The circular pitch and number of teeth in a wheel being given, the diameter of the wheel and size of tooth parts are readily found. This is a very important point and should be carefully studied by everyone who has to do with laying out new work. The order comes to make a pattern of a certain pitch and with a given number of teeth. Or we may have a gear to be matched with another gear having a different number of teeth. We measure the circular pitch of the gear we have, and knowing the number of teeth to be on the new wheel we proceed as follows:

Dividing by 3.1416 is the same as multiplying by $\frac{1}{3.1416}$. Now $\frac{1}{3.1416}$ = .3183; hence multiply the circumference of a circle by .3183 and the product will be the diameter of the circle. Multiply the circular pitch by .3183 and the product will be the same part of the diameter of the pitch circle that the circular pitch is of the circumference of pitch circle. This part is called the module of the pitch. There are as many modules contained in the diameter of a pitch circle as there are teeth in the wheel.

Most mechanics make the addendum of teeth equal the module. Hence we can designate addendum; that is, let S= the module.

.3183 P^1=S, or circular pitch multiplied by .3183=S or the module.

Ns=D^1, or number of teeth in a wheel, multiplied by the module, equals diameter of pitch circle.

(N+2) s=D, or add 2 to the number of teeth, multiply the sum by the module and product will be the whole diameter.

$\frac{t}{10}$=f, or one tenth of thickness of tooth at pitch line equals amount added to bottom of space for clearance.

Some mechanics prefer to make f equal to 1/16 of the working depth of the teeth, or .06257D^{11}. One tenth of the thickness of tooth at pitch-line is more than one sixteenth of working depth, being .7854D^{11} in.

Example.—Wheel 30 teeth, 1½ in. circular pitch. P^1=1.5; then t=75 in. or thickness of tooth equals ¾ in. S= 1.5 in. x .3183=.4775=module for 1½ in. P^1.

D^1=30x.4775 in.=14.325 in.=diameter of pitch circle.

D=(30+2) x .4775 in.=15.280 in.= diameter of addendum circle, or the diameter of the blank.

f=1/10 of .75 in.=.075 in.=clearance at bottom of space.

D^{11}=2x.44475 in. clearance at bottom of teeth.

D^{11}+f=2x.4475 in. .075 in.=1.0299 in.=whole depth of space.

s+f=.4775 in.+.075 in.=.5525 in.= depth of space inside of pitch line.

D^{11}=2s or the working depth of teeth is equal to two modules.

In making calculations it is well to retain the fourth place in the decimals, but when drawings are passed into the workshop, three places of decimals are sufficient.

The distance between the centres of two wheels is evidently equal to the radius of pitch-circle of one wheel added to that of the other. The radius of pitch-circle is equal to s multiplied by one-half the number of teeth in the wheel.

Hence, if we know the number of teeth in two wheels, in mesh, and the circular pitch, to obtain the distance between centres we first find s; then multiply s by one-half the sum of number of teeth in both wheels and the product will be distance between centres.

Example.—What is the distance between the centres of two wheels 35 and 60 teeth, 1¼ in. circular pitch? We first find s to be 1¼ in.x.3183=.3979 in. Multiply by 47.5 (one-half the sum of 35 and 60 teeth. and we obtain 18.-899 in. as the distance between centres.

In laying out pattern for gears, allowance must be made for shrinkage. For gears one to two feet in diameter it is well enough to add about 1/100 of the diameter of the finished gear. In gears about six inches in diameter or less, the molder will generally rap the pattern in the sand enough to make any allowance for shrinkage unnecessary. In gears cut from an iron blank we have shown in a former lesson that the tooth and the space between the teeth are to be the same, but if a cut gear is to be used as a pattern it is in a similar position to a wooden pattern and the spaces between teeth should be cut wider than finished gear spaces, in order to allow for rapping and to avoid having too much cleaning to do in order to have the gears run freely. In cut patterns of iron it is generally enough to make spaces .15 in. to .02 in. wider than the teeth. This makes clearance of .03 in. to .04 in. in the patterns some molders might want .06 in. to .07 in. clearance.

LIGHTNING'S BETTER FEATURES

We hear innumerable stories about the depredations of lightning and have learned to look only on its bad characteristics such as striking telegraph wires and killing line men fifty miles away or following the power line down into a coal mine and setting off the dynamite chamber, but we seldom think of it as a benefit to mankind, but it has been known to have remarkable restorative properties in cases of incurable disease. In Connecticut a woman who was as deaf as a lamp post had her power of hearing restored in a marvelous way. To penetrate to where this woman was in her house the bolt had to shatter several rafters, pass through two floors and demolish windows and frames before reaching her body. She became unconscious and was badly shaken up, but upon regaining her senses was well able to hear.

A case somewhat opposed to this but equally as remarkable was that of a man who had been afflicted with paralysis from infancy and who was struck by lightning and rendered unconscious for a short time, but after recovering from the shock he gradually regained the use of his limbs but was permanently deaf.

A woman who had been paralyzed for thirty-eight years was struck by lightning and cured.

Another woman who had paralysis of the vocal cords which rendered her speechless was struck by lightning and whether it was the lightning or the fright, she screamed and has since had the use of her tongue.

Many miraculous cases are recorded of people having their shoes and clothing torn off by lightning while receiving no bodily harm.

Another point worthy of note is that there is no record of anyone eve being struck by lightning while stitting in an automobile. This is probably due to the fact that rubber tires act as non-conductors, and unless the car is submerged in water, or the tires are deflated so that the rims form a contact with the ground, there is not the slightest chance of a car being struck by lightning.

Improving Quality of Foundry Sand Mixtures

Everything Points to the Advantage of Muller Type of Mixer, but It Must Not be Allowed to Have a Grinding Effect on the Grains of Sand

By HENRY B. HANLEY

IN THESE times it is, of course, exceedingly important to reduce the cost of foundry sand mixtures, not only by decreasing the amount of new sand used but also by increasing the quantity of old sand that can be used over again.

Sand preparation has only recently received the attention that it deserves, probably because other problems occupied the attention of the foundrymen and were considered more important from the standpoint of the quality of the castings and the cost of production. Different methods of molding mixtures of metal for various weights of castings and for castings for different purposes have occupied the attention of the foundrymen to the exclusion of the now considered important sand mixing department.

There is no doubt that ultimately ways and means will be found to use up all of the old sand; also, that the old cores will be broken up and used again. Furthermore, unless the foundry is so small that it cannot afford the expense, it is absolutely necessary to employ a metallurgist or chemist to experiment with the different kinds of new sand, to investigate the possible reduction of binders for core sand with the use of cheaper binder than was formerly used, and generally to supervise the more thorough and more economical preparation of molding sands.

It is believed by many engineers who have studied the subject that the most satisfactory means of mixing is by the use of a muller type of machine, provided that the mulling action does not destroy the original structure of the sand, but simply incorporates the various ingredients into a uniform mixture, at the same time maintaining its original porosity.

Locating the Mixing Department

It is important properly to locate the sand mixing department, so that the new sand can be delivered as automatically as possible into the mixing machine, and to take away the resultant mixture quickly and economically, thus securing the maximum capacity from the mixer. Also, where one machine is used for bot facing and core sand, it should be located so that the core mixture and the facing mixture can be transported to wherever they are to be used in the foundry with as little delay and expense as possible. Likewise, the return of the old sand to the machine should be kept in mind, so that the expense of so doing will not counteract the advantage of using up the old sand. It is important that the sand be distributed so that the molders will not have to wait at any time for a fresh supply of sand.

Hand mixing is absolutely a thing of the past, not only on account of the labor conditions at the present time, but also because of the reduction in cost, as obviously it is impossible to reduce the quantity of sand that is required, by hand mixing, as can be done mechanically.

Accurate records should be kept of various mixtures required for certain classes of work and the cost of such mixtures be proportioned per ton of castings. In other words, the cheapest mixture than can be used in any particular class of work should always be determined, and then this particular mixture should be absolutely maintained.

Time of Mixing

The time of mixing should be very carefully investigated, as in core sand especially it is just as bad to mix the sand too long as not long enough, as more expense is necessary in continuing the mix beyond the time required. I have heard a great many foundrymen make the statement that poor sand preparation is responsible for more lost castings than any other cause.

It is also possible with the muller type of mixer to secure a good distribution of sea coal particles for facing, and to decrease the amount of sea coal that is required. Consider the immense saving in time effected by the molder in finishing the mold that is made with well mixed sand; the mold will not fall to pieces so easily and therefore requires less finishing. The metal will not cut into the mold because the sand presents a tougher exterior. It is not difficult to note the difference, by observation in the core of the rough loose edges where the sand is not properly mixed. These edges, of course, are liable to wash off and the pieces get to the top of the casting and cause endless trouble in the machine shop, resulting in the scrapping of the castings.

Where a foundry uses mostly green sand it is all the more important to prepare it properly, especially where there is a variety of castings of both heavy and medium weight. In such cases mixtures of sand can be produced with small additions of binder and sea coal that are quite economical. On the other hand, mixtures are required with much stronger bond and more careful manipulation. It is oftentimes desirable to arrange for various bins for the different mixtures, so that there is no chance of using a mixture that is not adapted to the particular class of work to be done.

Another valuable use of the sand-mixing machine is that very tough sand can be cheaply made for large copes because less sea coal is needed and the cope part of the mold is not so apt to scab; also the cope is much less liable to drop out, as is often the case with poor facings.

In our experience with the muller type of sand machine, we found it important to make a careful adjustment of the mullers so that they do not rest on the pan. In this way there is little danger of grinding the material to a powder. On the other hand if the muller is in contact with the pan a continuous grinding goes on which is harmful for any sand. In the first place, the grain size and grade of the mixture is altered and the whole mass is broken into fine, sharp particles. When such sand is dumped out, it does not feel right, is weak and very sharp. With proper attention to the position of the muller excellent sand can be obtained at all times in not exceeding five minutes of mulling. This will give the maximum bond for the mixture use. Mulling for three minutes will give nearly the same bond as five minutes. The ultimate bond is dependent on the mixture used, the temper, the revolutions per minute and the time.

Influence of Additions of Sea Coal

While conducting a number of tests on green sand facings that contained sea coal, we were surprised to find that the sea coal had a serious effect on the bond. Tests were made to determine to what extent sea soal could be used in good facing and still have the bond required for safe working. A mixture was made of old sand 60 per cent. and new sand 40 per cent., no sea coal being used. The molds were blacked, and the casting came out fine. Next, 3, 6 and 9 per cent. additions of sea coal were tried. On passing 6 per cent. the bond was so seriously weakened that quite poor castings were produced. All of these mixtures were prepared in the muller previously described and were mixed in five minutes mulling. After a careful investigation, it was learned that the sea coal breaks up the continuity of the bond imparted by clay or impurities. This weakness attributed to sea coal could easily have been overcome by additions of more new sand, but since this means increased cost for facing it was decided to adopt the safe working limit of 6 per cent for facing intended for medium weight castings.

Reclaiming Old Sand

In selecting molding sands, we have tried to secure strong bond sands at all times. We find there is economy in the purchase of these strong bond sands because they will go further than a sand of weak bond in adding to old sand or in making a facing. One can appreciate the effect of adding 10 per cent. of extra strong stove plate sand to the heap sand, when to begin with the stove plate sand selected for this work contains double the bond of other sands. There are some advantages about reclaiming old sands with strong bond new sands, that should appeal to those who do not have a muller. It is not so difficult to mix thoroughly the two sands as it is when the mixture of clay is undertaken.

To make clear the influence of selected strong bond sands for reclaiming purposes, our experience has been that they are economical and safe in plants where there are no means of controlling the reclamation work, such as tests that show exactly what the bond and other qualities are.

Reclaiming Sand With Ordinary Fire Clay

We have found that fire clay is not suited to molding sand work for the simple reason that it takes too much clay to develop the bond when added to old sand. The reason for this is in the fact that fire clay does not possess any amount of plasticity but is generally nonplastic. We have found additions of 10 per cent. fire clay a serious detriment in sands intended for facing, because with the clay in the old sand plus the added clay which made a total of 20 per cent., troubles in venting and blowing developed. On cutting the fireclay addition down to 5 per cent., the troubles were eliminated, but the bond was not reliable. If the molds dried out from long standing the cope would drop from weak bond. When mullers were first introduced for sand reclamation, it was thought possible to take any foundry clay, add old sand, and make new molding sand. This idea is disappearing, because the knowledge of clay to-day shows that there is a great variety to select from, each having a different bond and plasticity. Excellent results are obtained when the proper clay is chosen for the work, as the following table indicates:

	Ordinary Fireclay
Bond absorption figure	2000
Transverse strength.	15 lbs. per sq. in.
Clay substance plus impurities, per cent.	96 per cent.
	Selected Plastic Clay
Bond absorption figure	12,000
Transverse strength.	275 lbs. per sq. in.
Clay substance plus impurities, per cent.	98 per cent

In selecting the clay to be used, a strong bond plastic clay should be specified. As the table shows, practically the same amount of clay is used, but its quality and its influence on the ultimate strength or bond of the sand being reclaimed will differ enormously. This has been explained previously and is due to the superior physical quality and not the chemical quality of the selected plastic clay.

Reclaiming Sand With Selected Plastic Clay

When one changes from the use of ordinary fireclay to a strong plastic clay and attemps to rejuvenate the old sand, an entirely different result is obtained. With the plastic clay, a good strong bond that is reliable is secured. Only a small amount, 5 per cent. or sometimes less, is required to develop an excellent feeling in the worn out sand. This is a tempting line of investigation because it offers a considerable return, on account of the great economy possible. Backing sand for heavy work needs nothing more than a small amount of plastic clay and a few minutes in the muller. When one considers the vast differences in properties of clay that are suitable for this line of work, it is easily understood that the future advances will be made not by using the ordinary fireclay but the selected plastic clay.

Method of Adding Clay to Sand Mixtures

It is still a matter of argument between foundrymen as to the best way to blend sands in order to get the best results. Some prefer the dry mixing method and then tempering; others prefer to mix and temper at the same time. Our experience has shown that wet mixing in a muller develops about all we expect from the ingredients. We have had the best results by adding clay in the form of emulsion, while the machine is in operation. This allows the clay to spread over the surfaces and avoids lumps in the mixture. It is entirely a matter of clay dispersion over sand surfaces that makes ultimate bond. We all know that a liquid condition for the added material is superior to the dry condition. By mixing the clay with water we can develop the maximum amount of bond with the minimum amount of clay.

Utilization of Local Sands

When we have a muller at our disposal, we find that it is thoroughly practicable to utilize some of our local sands by adding 25 per cent. to our new facing sand mixtures. In this way we are saving 50 to 75 per cent. against the cost of new molding sand brought from long distances. A good mixture for medium weight castings can be prepared in a muller by taking 50 per cent. old sand, 25 per cent. local sand, 23 per cent. of new sand and 2 per cent. of selected plastic clay. It is of importance, however, to first know that the local sand is of refractory character. It matters not whether it contains clay or other bond; this can be put into a mixture at will.

Quality of Work With Reclaimed Sand

The quality of the work produced is the main consideration in sand reclamation. The results obtained so far are decidedly in favor of mechanical treatment of the sand. When a mixture is found satisfactory for a certain line of work it can be duplicated, thereby giving each molder the same quality of sand. This avoids the personal equation where each man thinks he is better prepared on his own facing requirements than the next one. We have seen hundreds of important castings come exactly the same in surface appearance day after day. They were not made from exactly the same formula for sands but the texture and bond were what was required for the job. In order to have complicated castings free from sand defects it is necessary to give the sand mixing some study.

WHY IRON CAN BE BENT WHEN HEATED

The Wheeler Syndicate in their daily "Why" have the following article on cold and heat.

"In common with other substances, such as glass and various metals, iron is quite rigid when cold or at the average temperature, but the application of heat makes it pliable and susceptible of being fashioned into a number of shapes. In fact the general rule that the colder they are the more rigid, applies to practically all substances has even found its way into metaphorical language, for we speak, for example, of a person as having a 'cold, unbending will.' Here, of course, the meaning is figurative, rather than literal as in the case of iron.

"The application of heat to any substance, however, will cause it to expand—sometimes only very slightly as in the case of metals, sometimes violently, as in gunpowder or other high explosives. But the expansive power of the heat is always in force and in the individual molecules rather than in the sudden increase in size of the metal as a whole. In other words the heat moves the molecules further apart and causes them to lose something of the strength of their hold upon each other. The result is that the iron as it is heated, becomes more and more pliable until it finally reaches the point where it is a liquid and can be handled like a thick soup. The moment it cools, however, its molecules press tightly against each other and its original rigidity returns."

The above is interesting and is, in the main, correct. It is in fact as near correct as a daily newspaper can be expected to get, on a technical subject, but there are a few little points which will stand investigating. For instance it says:—"the application of heat to any substance will cause it to expand. Now as a matter of fact there are metals which contract when heated and expand when cooled. Take the metal 'antimony'. Its principal use is as a constituent of alloys, as type metal, to which it imparts hardness and the property of expanding on solidification, thereby filling every detail of the mold. Another example is that of Bismuth, one clause in the definition of this metal is that it is used chiefly in the formation of alloys, which are characterized by low fusibility and by expanding on solidification. An old saying is that there are exceptions to every rule, and it seems to be true, and the metals have their exceptions along with the rest, but on general principals, metal expands when melted.

Two Industrial Leaders of Canada Removed

Each a Peer in His Own Manufacturing Realm With Rare Achievements in Business Building—Late Mr. McClary Attains a Ripe Age—While Mr. Findley is Taken in Early Life

SINCE the last issue of this publication Canada has witnessed the passing of two of her most prominent industrial pillars, John McClary, founder of the McClary manufacturing Company, London, Ont., who died on Sunday morning, Dec. 11, and Thomas Findley president of the Massey-Harris, Company, who died at his home in Toronto, on Monday Dec. 19.

The one had attained more than a score of years beyond the allotted span of life, while the other was plucked in the prime of life, a score of years before his time. Each began at the bottom round and worked his way to the top; each remained at his post until the end.

John McClary was born on a farm near Nilestown, a village about six miles from London on Jan. 2, 1829. His father was originally an American, being descended from an Irish family who emigrated to the United States in the 17th century. On his grandmother's side his ancestry traced back to General Stark, one of the famous generals of the American Revolution, and through his grandmother he is also related to John Adams and John Quincy Adams, second and sixth presidents of the United States.

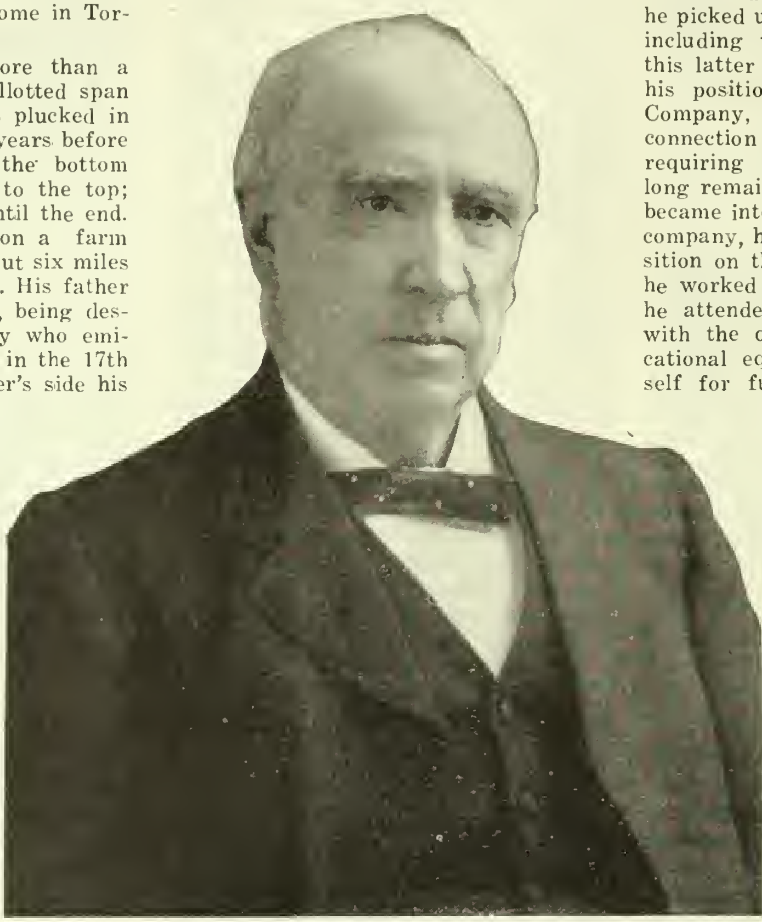
Mr. McClary spent the first eighteen years of his life on the farm after which he moved to London, where he remained the balance of his days, with the exception of a short period in California during the gold rush of 1849.

On leaving the farm, and before going to California he served an apprenticeship at the trade of tinsmithing and on his return from his trip, entered into partnership with his brother Oliver under the firm name of J. and O. McClary in the business which, although exceedingly small at the time, expanded into the enormous McClary Manufacturing Company of today, operating the largest stove foundry in the British Empire, and among the largest in the world.

The late Mr. McClary was undoubtedly the oldest active business man in Canada. He was at his office as usual on Friday before his death. On Saturday he was taken seriously ill, and in spite of all that medical skill could do he passed away on Sunday morning within sight of his 93rd birthday.

In addition to his position at the head of the McClary Mfg. Co. he was president of the Ontario Loan & Debenture Company, a past president of the London Life Insurance Co., and a director of the London & Western Trust Co. He had, years ago, been a Justice of the Peace. In religion he was a Methodist.

Mr. McClary, although descended from American Revolutionary Stock, was married in 1853 to Mary Ann Drake, daughter of Phineas Drake of United Empire Loyalist descent. By the marriage they had two daughters, Mrs. Theresa Gunn, whose husband, E. A. Gunn, now deceased was a former Secretary of the McClary Mfg. Co., and Mrs. Gartshore, wife of Lt. Col. W. M. Gartshore, manager of the McClary Co. His first wife died in 1862, and he later married Miss Mary Jane Pavey who predeceased him in 1909.



LATE JOHN McCLARY

Story of His Rapid Progress

Thomas Findley also began his career on a farm. He was of Scotch descent and was born Dec. 16, 1870 or just fifty-one years ago, the son of Thomas and Agnes Findley at Bond Lake, York County, only a few miles to the north of the city in which he was later to make a career for himself as a manufacturer of devices designed to lighten the labor of such farmers as those among whom he had passed his childhood and boyhood. The first sixteen years of his life he spent on his father's farm, and during this period he attended the public school at Sutton West, Ont., where he received such instruction as the facilities of a little rural school could provide. He did not enter a high school after completing his public school course, not because he did not wish to continue his studies, but only because of circumstances that kept him from continuing them as he would otherwise have done.

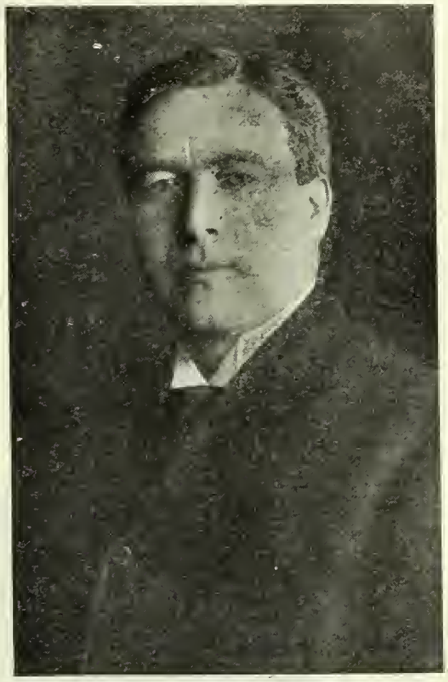
His first venture of earning a living was as a junior in the little store of the village, which store included the Post Office and the Telegraph Office. Here he picked up a lot of valuable knowledge including that of telegraph operating; this latter being the stepping stone into his position with the Massey-Harris Company, who had a direct telegraph connection with their office and were requiring an operator. He did not long remain at this particular work, but became interested in the activities of the company, he was soon promoted to a position on the book-keeping staff. While he worked at his books during the day, he attended Y.M.C.A. classes at night with the object of improving his educational equipment and preparing himself for further advancement, which came rapidly, and in 1895, five years after joining the Massey-Harris Company's staff he became the chief accountant for the Company.

His promotion right through to the higher positions was rapid. In 1920 he was appointed assistant general manager, in 1909 a director, and in 1912 vice-president. In 1917, on the death of the president, Senator Lyman Melvin-Jones, the company was reorganized and Mr. Findley was appointed to the dual office of president and general manager. Although it was known that this was too much for any one man, it was not until November 1920 that Mr. Findley was relieved of some of the burden, on the appointment of Mr. Thomas Bradshaw to the position of General Manager.

Mr. Findley was not only a success as a business man but was extremely popular with the employees, as was shown by their actions on Christmas Day, 1919, when he was presented with an illuminated address, in red morocco cover, and signed by no fewer than 4000 of the employees of the Massey-Harris Co.

Mr. Findley was appointed last July as a member of the League of Nations committee of disarmament. In addition to his connections with the Massey-Harris Co. he was a director of the Canadian Bank of Commerce; a prominent member of the Canadian Manufacturers' Association of which he had been chairman of the legislative committee on different occasions, and also a member of the executive council. He was also a member of the general board of finance of the Presbyterian Church of

Canada; a prominent Y.M.C.A. worker and a member of the Bloor Street Presbyterian Church, in which Sunday school he had been superintendent for fifteen years. He was married in 1894 to Phoebe Constance Smith, daughter of Samuel Smith of Kingston, who survives him, along with their two sons, Irving and Alan, and their daughter Margaret.



THE LATE THOMAS FINDLEY

SCHOOL CHILDREN AND SAFETY

The Committee of Judges in the recent safety essay contest have prepared for the Executive Committee of the Ontario Safety League some interesting figures regarding the distribution of the prizes. It will be remembered that in May last, the Ontario Safety League announced a competition for the best essays by school children on the subject "How Children May Help to Avoid Motor Accidents." Cash prizes amounting to Two Hundred dollars in all were donated by the Ontario Motor League. This amount was divided into 140 prizes varying in value from Ten Dollars to One Dollar. In order to give reasonably equal chances to all children, the prizes were divided into two classes:—

Class A, being for children 12 years and under.

Class B, being for children 13 years and over.

It is an undoubted fact that many lives are lost as a result of lack of thought or knowledge, or in other words, lack of education. The Motor League had this in mind when offering the prizes, as experience has shown that accidents involving automobiles and children can be systematically reduced by teaching children in their homes and in their schools how accidents are caused and how they can be avoided.

An analysis of the list of prize winners in this competition is unusually interesting and indicates most clearly how thoroughly the teachers in some of the schools have realized the importance of the subject. On the other hand, some of the results of the competition are remarkably unexpected and in direct contrast to what would be generally expected.

One would naturally anticipate that in the larger cities, where automobile accidents are of almost daily occurrence, and where, therefore, the necessity of safety teaching is obviously the more imperative, the children of those cities would be so steeped in safety knowledge that, in a competition such as this, they would carry off practically all the prizes The actual results of this competition tell a very different tale

The first prize in Class A was won by a pupil attending school in a place not shown on most maps—Locust Hill; and the pupils of this school also won three prizes in Class B. The pupils in one school in Guelph won 2 prizes—15 in Class A and 5 in Class B. As against this all the schools in Toronto together claimed only 21 prizes, and 12 of these were won by pupils of "Separate Schools." Galt scholars took 7 prizes, whilst scholars attending the schools at Ottawa and Windsor each took only one. In Peterborough the children under 12 took one prize whilst those of 13 or over were awarded 8. The largest number of prizes in one city was secured by Hamilton with a total of 24. 102 prizes were won by girls and 38 by boys.

The 140 prizes were distributed as follows:—

Hamilton 24, Toronto and Guelph each 21, London 11, Peterborough 9, Galt 7, St. Catharines 5, Fort William and Locust Hill each 4, Welland and Fairbank each 3, Watford, Downsview, Oakville, Barrie, Ford, Ridgetown, Whitevale and Brantford each 2, Bolton, Chatham, Milton, Caledon, Weller's Bat, Windsor, Niagara Falls, Ottawa, Komoka, Humber Bay, Omagh and Union each 1.

Interesting deductions may be drawn from these results. Attention is drawn to the figures by the Committee in the hope that those teachers whose pupils have done well in this competition may be encouraged to increase their efforts, whilst others may be influenced to emulate the more successful competitors by instilling into the minds of the rising generation the essential principles of safety propaganda—how accidents happen and how they can be prevented—not only from automobiles, but from any cause.

DIFFERENT PEOPLE SEE THINGS DIFFERENTLY

Philip T. Dodge, president of the International Paper Company and of the Mergenthaler Linotype Company, in an address before the Industrial Relations Association of America at the Waldorf-Astoria, hotel, New York, said that his thirty years' experience in employing men had convinced him of the soundness of the open shop policy.

He stated further that he felt so strongly in the matter that if either of his companies receded from their firm stand for the open shop he would resign, adding that his companies always recognized shop committees and were glad to confer with them, but that they absolutely refused to recognize or deal with any third party.

In reply to this a different stand was taken by S. Seebohm Rountree, a director of Rountree & Company, Limited of New York and London, who expressed his belief that the best interests of both employers and employees were served by co-operation with the trades unions.

Obviously there is a difference in employers as well as employees whether union or non union.

WORK FOR THE WORKLESS

S. C. Hadden, Editor and General Manager of "Municipal and County Engineering" an Indianapolis publication in a lengthy article has the following paragraph which is applicable to most Canadian towns at the present time and is a commendable suggestion. Here it is.

"Turn either to the right or the left in your home town and you will find all the work waiting that the jobless can perform this winter and for some time to come. Schools, hospitals, park improvements, sewers—all classes of municipal work—have long been needed and their need is more urgent now than ever because of long deferred action

Let's defer no longer! Let's act now!

This is the surest way to permanent prosperity."

FREE INFORMATION

Questions Answered re Scientific Instruments

The Research Information Service of the National Research Council is prepared to supply to those interested in information about scientific instruments, apparatus and supplies, laboratory construction and equipment.

The following samples of requests answered recently:

"Where may we purchase inexpensive photomicrographic apparatus?"

"Where may a human skull be purchased?"

"Who manufactures a good grade of selenium cells?"

"Advise where lantern slides on European Geography may be obtained."

"Where may the Lummer-Brodhun cube be purchased?"

"What concern makes gauges recording in fractions of an ounce?"

"Where may apparatus and accessories for study of sensitiveness of photographic plates be secured?"

Address requests: National Research Council, Information Service, 1701 Massachusetts Avenue, Washington, D. C.

The Casting Of Aluminum And Aluminum Alloys

Various Formulae Brought Out in America and England Since the Outbreak of the War, and to Considerable Extent as a Result of the War

By ZAY JEFFRIES

Last month we showed that while aluminum castings have been made in sand molds, ranging in weight from one ounce to as high as 480 lbs., neither of these weights should be considered as an extreme limit.

33 In the permanent-mold process the maximum weight is about 20 lb. and the minimum weight about 1 oz. Permanent-mold castings have been made weighing as high as 150 lb. but these large castings should be considered as special.

34 Section Thickness. On gas-engine oilpans the walls should be 3/16 in. or more in thickness and on crankcases a wall thickness of 7/32 in. or greater is common practice. Fillets should have large radii, especially where heavy sections join thin sections. The best thickness on pipes, manifolds, etc., is ⅛ to 5/32 in. The minimum thickness on permanent-mold castings is 3/32 to ⅛ in.

35 Finish. On large castings ⅛ in. should be allowed for finish and on bench work 1/16 in. A finish of 1/32 in. should be allowed for disc grind.

36 The finish on permanent-mold castings up to 3 in. in diameter, for example, pistons, should be about 0.075 in. on the diameter, and the finish on the piston head should be 0.045 in. The finish on permanent-mold pistons over 3-in. in diameter should be about 0.093 in.

37 Tolerances on Dimensions and Weights. In sand castings a tolerance of 1/32 in. in thickness should be allowed in permanent-mold castings the tolerances are plus or minus 0.010 in. The weight tolerances on sand castings using metal-pattern equipment are plus or minus 3 per cent. and with wood patterns plus or minus 5 per cent. The weight tolerances on permanent-mold castings are plus or minus 2 per cent.

38 Machining. For roughing cuts speeds of 500 to 700 ft. per min. and a feed of 1/16 in. to 5/32 in. are recommended, according to the nature of the work. No lubrication is recommended for roughing. For extra fine finish a speed of about 125 ft. per min. is recommended, but speeds up to 600 ft. can be used and satisfactory finish obtained. For turning, the finishing feeds should be from 0.01 in. to 0.125 in., and for planing up to 0.25 in. A good lubrication mixture for finishing is 70 parts kerosene and 30 parts lard oil.

39 Aluminum alloys take a fine finish by grinding. Good results have been obtained using a No. 40 grain crystolon wheel and a mixture of 10 per cent. lard oil and 90 per cent. water for lubrication. The grains of the crystolon wheel even when dislodged do not stick in the metal.

Heat Treatment of Aluminum-Alloy Castings

40 Experiments have indicated that the tensile properties of aluminum alloys are considerably improved by heat treatment, but these developments are so new and have gained so little headway in production that the subject will not be treated in this paper.

41 Aluminum castings, especially those containing copper, may have their volumes permanently changed by heat treatment. Also the hardness may be changed. These facts are taken into consideration in connection with the heat treatment of aluminum-alloy parts such as pistons which will have to operate at an elevated temperature. The pistons are given a heat treatment which will cause permanent growth to such an extent that no additional change of volume will take place during normal running.

Aging

42 Nearly all aluminum-alloy castings change in physical properties at room temperature after casting. This change in properties is called "aging" and is caused by the same internal changes which change the properties of the alloys by heat treatment. The general effect of aging is to increase tensile strength and decrease elongation. The elongation may be reduced by aging from 2 per cent. to 1 per cent. in the 8 per cent copper alloy, or from 8 per cent to about 6 per cent. in one of the more ductile zinc alloys. This aging should cause no worry to engineers because, although it was not suspected in the past, the alloys which have been used for years have aged without harmful effects.

Effect of Thickness of Section on Physical Properties of Aluminum Alloys

43 In general, the tensile strength and elongation of the aluminum alloys decrease as the thickness of the section increases. In the case of round test bars cast as shown in Fig 1, the decrease in tensile strength in an alloy containing 8 per cent. copper and 92 per cent. aluminum is from approximately 25,000 lb. per sq. in. and 3 per cent. elongation in the ¼-in. test bar, to 14,000 lb. per sq. in. and less than 1 per cent. elongation in the 1½-in. test bar, with proportional intermediate values for the ½-in. and ¾-in. bars.

44 It appears that this alloy on account of its low elongation does not show up so well when tested in a large piece as would be indicated from the results obtained from small test bars machined from the larger pieces. For example, small test bars cut from the 1½-in. bars averaged about 19,000 lb. per sq. in. and the elongation was more than 1 per cent. elongation. The tensile strength of one of the zinc alloys described earlier decreases at an approximately linear rate from about 30,500 lb. per sq. in. in a ¼in. test bar to 19,500 lb. in a 1½in. test bar. Small bars cut from the 1½in. bar tested about the same as the 1½in. bar itself. The elongation of the zinc alloy decreases also with increase in thickness of section. It is thought that the greater ductility of this alloy is responsible for the similarity of results between the small test bars cut from the large bars and the large bars themselves.

Fig. 1.—Method of casting round test bars.

45 The lower strength and ductility of the large sections are due to a combination of variation in grain size and soundness of the casting. The smaller sections are as a rule better fed during solidification and since they solidify more rapidly than the thicker sections, they are also finer grained.

Effect of Rate of Chill on the Physical Properties of Aluminum Alloys

46 As a general rule, the more quickly aluminum alloys solidify the smaller the grain size and the higher the tensile

strength and elongation. No. 12 alloy, for example, when cast in large sections in sand may have a tensile strength as low as 14,000 lb. per sq. in. and an elongation of less than 1 per cent.

Fatigue Resistance of Aluminum Alloys

47 In sand-cast bars of No. 12 alloy the fatigue resistance as measured on the White-Souther machine is about 14,000 lb. per sq. in. maximum stress for 500,000 reversals and about 8500 lb. per sq. in. maximum stress for 16,000,000 reversals. The proportional limit of this alloy is about 5000 lb. per sq. in. The stress-strain curve departs very gradually from a straight line after the proportional limit is exceeded, as is shown in Fig. 2. It is believed that the proportional limit of the aluminum alloys does not represent a breakdown of the main metallographic constituent, as in a single compounds and thus causes slight perthat it simply breaks some of the unfavorably situated, brittle aluminum compounds and thus causes slight permanent set. The fatigue life of the aluminum alloys is quite unusual, inasmuch as the safe limit seems to be equal to or higher than the proportional limit as measured by the extensometer. Chill-cast alloys are even better than the sand-cast alloys for fatigue resistance.

48 In a very comprehensive paper entitled Aluminum Alloys for Aeroplane Engines, by Professor F. C. Lea, published by the Royal Aeronautical Society in 1919, fatigue tests on various aluminum alloys are reported, together with stress-strain diagrams. These tests show a minimum fatigue range in the Wohler test of 12,000 lb. per sq. in. (—6000 to + 6000) for 12,000,000 reversals on an alloy containing 12 per cent. copper. The proportional limit of this alloy was 5000 lb. per sq. in., although the amount of permanent set up to 6000 lb. was very slight.

General Considerations Regarding Use of Aluminum Castings

49 As an engineering metal aluminum is in a class by itself because of its low specific gravity. Its use is determined by many factors among which are the following:

a Where lightness is of prime importance, aluminum in sheet form has about seven times the stiffness of steel for equal weights. For a given rigidity in any metal structure aluminum will weigh less than any other metal used in engineering. For such parts, therefore as aeroplane engine crankcases, camshaft housings, oilpans, etc., where lightness and rigidity are of prime importance, aluminum alloys find extensive use.

b In the manufacture of gas-engine crankcases it is found that the aluminum castings can be machined about three times as rapidly as cast-iron parts, and consequently the first cost of plant installation and labor cost of machining is greatly decreased by the substitution of aluminum for cast iron. The lightness of the crankcase is the chief advantage because the weight of the engine per horsepower is reduced.

c Where the lightness of reciprocating parts, like pistons, is of great moment, such as in high-speed gas engines, the use of aluminum is very beneficial. The aluminum piston also has the advantage of high heat conductivity, which is sometimes of greater importance in a gas engine than reduction in weight.

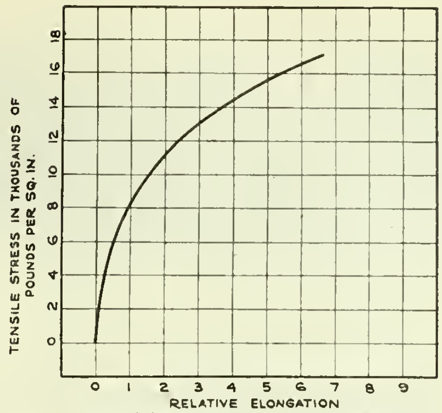


Fig. 2—Stress-strain diagram of alloy containing 92 per cent. aluminum and 8 per cent. copper.

d For reducing unsprung weight in motor vehicles, aluminum is particularly valuable. This includes such parts as differential carriers, rear-axle housings, brake shoes, hub caps, wheels, etc.

e Aluminum alloys, especially with moderate pressures, function nicely as bearings against hardened steel. As an example, the Liberty Engine camshaft was run in aluminum bearings, as were also the rocker arms. Aluminum alloys, however, do not bear well against soft steel.

f For equal volumes aluminum is cheaper than brass or bronze. Aluminum alloys find extensive use as a substitute for brass and bronze castings where freedom from atmospheric corrosion is of prime importance and where the strength requirements are not too severe.

Selection of Alloy

50 For aluminum castings not highly stressed, No. 12 alloy should be used. Where freedom from leaks is the main requirement, the 12 per cent. copper alloy is good and the more ductile zinc alloy should be used for highly stressed parts. Present-day engineering materials are required to stand abuse rather than normal use. Ductility is essential if an alloy containing 2.75 per cent. copper, 1.5 per cent. iron and 7 per cent. zinc.

WHITE GOLD

Any one who is interested in jewelry or diamond setting has undoubtedly become more or less familiar with white gold during the last few years but very few people seem to know what it is. The fact that it sells for less money than platinum convinces them that it must be a spurious compound, but it is not. In order to explain the phenomen of white gold it is necessary first to refer to platinum and also to pure unadulterated gold.

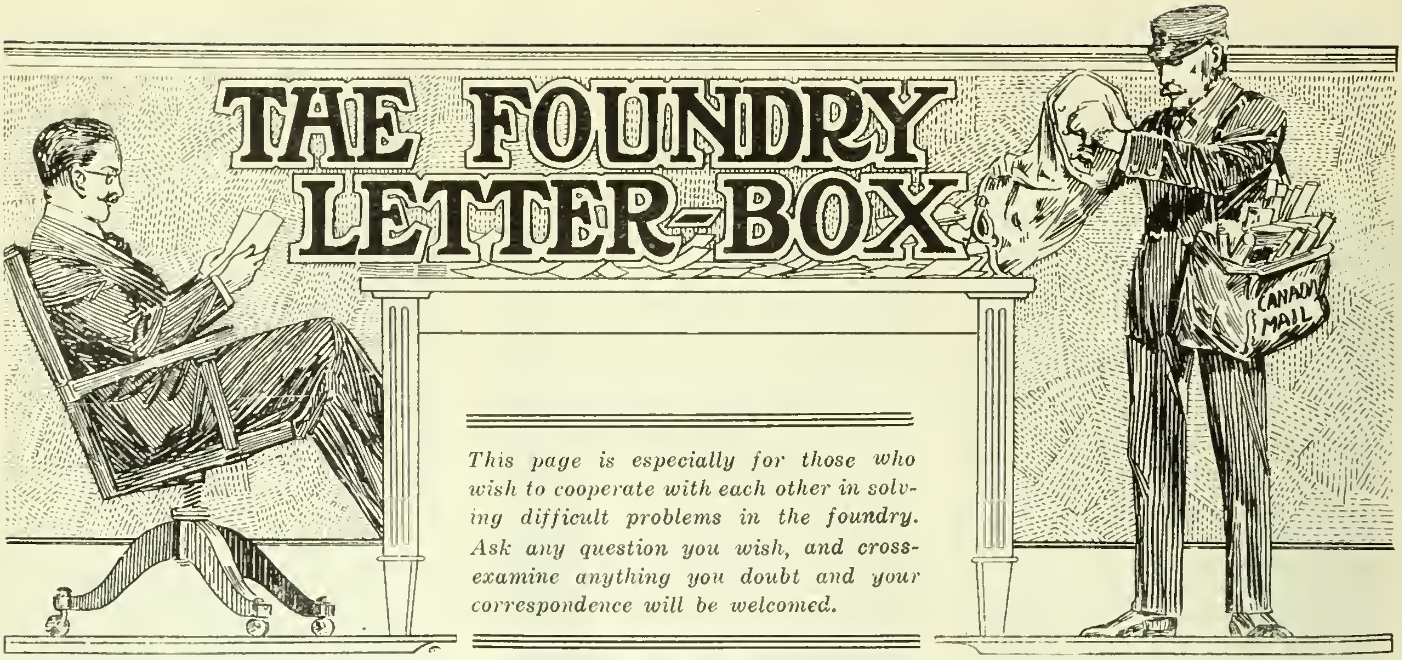
Humanity is queer, and longs for anything which is difficult to procure. Gold, because of its scarcity had long been looked upon as the most precious of metals and was, as a consequence, the chief source of supply for jewelry. It has also become the standard of valuation throughout most of the civilized world, and practically every nation has some of its coins made from this metal. Gold has a standard value which never changes, namely $20.67 per ounce.

Silver, another precious metal has been known and prized throughout ages, but silver is cheap compared with gold, being about one twentieth of its value, or less according as the market fluctuates. But this is ancient history. In the year 1741 a new metal was discovered in the Choeo mines in Peru by Charles Wood an Assayer from Jamaica. This metal is Platinum and has since been found in different parts of the world but it is rare. Platinum is the heaviest of the metals, is very ductile and malleable. It is almost as white as silver and takes a high luster, but it is in no way superior to silver in appearance. The fact that it is very hard to get and exceptionally difficult to refine, and impossible to melt with anything less than an electric spark makes it, of necessity very expensive, and for this reason "humanity" demands it for jewelry although it takes an expert to tell it from silver. The demand thus created naturally increased its market value and incidentally the temptation to imitate it.

In the ore from which platinum is extracted is another metal known as palladium. This metal is never found, excepting with platinum, and was never of any great value until it was found that by alloying a small amount of it with pure gold it had a bleaching effect which produced a metal, hardly distinguishable from platinum. This is what is known as white gold. This, of course raised the price of palladium until it now sells at $60 per ounce, but with gold at $20.67 per ounce, which price never changes, a slight amount of palladium at sixty makes very little difference in the cost of white gold from that of pure gold which is far short of $80.00 per ounce, the price at which platinum is quoted. While platinum is sought after as a metal from which to make jewelry it has other and more useful uses where its heat resisting and acid resisting qualities are invaluable, and where substitute, will not do, but for jewelry "white gold" is good enough, and while it is only an imitation it is not spurious.

A shower of rain generally succeeds lightning because the equilibrium of a certain amount of electricity having been restored, the clouds, deprived of their electricity, collapse into rain.

In case of fire in one's clothing do not run, especially don't run down stairs or out-of-doors. Roll on the carpet or wrap in woollen rug or blanket. Keep the head down, so as not to inhale the flame.



This page is especially for those who wish to cooperate with each other in solving difficult problems in the foundry. Ask any question you wish, and cross-examine anything you doubt and your correspondence will be welcomed.

HAS TROUBLE WITH CORE SAND MIXTURE

Editor Canadian Foundryman:—

As a reader of the Canadian Foundryman I often find a lot of good suggestions in it, and now I would like a little information myself on some core mixtures for bibb and basin cock cores. I am having a little trouble with some of the seats of the bibbs, they blow. My losses are about three per cent. on bibbs, and five per cent. on basin cocks. Now could you give me a mixture that would work and still leave the interior of the casting smooth. I trust that you have the required information.

Answer:—The trouble which you are having has been the experience of most all brass foundrymen. Getting the vent away from such small intricate-shaped cores with such a thin covering of such sluggish metal as brass, is a difficult proposition. It is next to impossible to vent such cores properly, and unless the texture of the core itself is such that the gas escapes at once, there is apt to be trouble. Every core has some tendency to kick when hot metal strikes it, but melted iron will usually make good after the slight kick is done, while brass being sluggish will not. The only thing to do is to have cores which will not kick and to accomplish this, the material from which the core is made should not contain any loam or any other foreign matter such as is found in ordinary building sand. Pure silica sand mixed with a good oil binder in the proportion one of oil to fifty of sand is considered by most brass founders to be the best. This kind of a mixture cannot be stood on end or rolled onto a flat plate to be dried, but must be put into perfect-fitting driers. This means an outlay of money but it is well spent, as cores of this kind can be made without rods, wires, or vent holes. The sand does not require to be sharp sand, as the shape of the grain is not particular. As a matter of fact a grain without sharp corners will make a more open core, and the oil will hold it secure. Molding sand, mixed through the mixture makes easy work for the core maker but that is its only good feature. If pure, white silica sand is not to be had, the only thing to do is to get as near as possible to it. Good sand is frequently found along river banks and beaches, but where much core-making is done it is money in pocket to get car lots of real silica sand. The success of a core for any kind of work is in having it hard enough to resist the melted metal while not hard enough to prevent the natural shrinkage of the metal, strong enough to resist the strain of the metal and open enough to allow the gas to escape, and along with these characteristics have a binder which will resist the heat until the casting is set. Pure sand and pure linseed oil will accomplish this in any kind of a casting, iron or brass, heavy or light, but linseed oil being a slow material to bake and also expensive there are manufactured oils with a linseed base which are less expensive and more easily dried. These oils are for sale by all foundry-supply houses. It is not always necessary to use oil sand as there are cheaper compounds which are equally as good for some kinds of work, but for the work such as you are having trouble with, the oil sand should relieve you of all your trouble.

WANTS INFORMATION ON SCRAP IRON

Editor Canadian Foundryman:—

I have a question which I have been going to ask you for a long time, with regard to scrap iron. "Which will make the best castings, old stoves or old machinery?" The manager of the shop where I am employed argues that stoves are made of first-class pig iron, which is still in them when they go to the scrap pile, while machinery is usually made of half scrap and half pig. Some of our men agree with him and some differ, while I am undecided, and will leave it to you.

I have another question which I may as well include, along a similar line: "What effect does chilling a casting have on castings which will be made from this chilled metal later on? I have seen foundrymen using the chilled rim of a car wheel for castings which required to be hard while using the hub for ordinary work. Were they right in doing so?"

Answer:—To answer your questions in a proper manner would be a lengthy task, which would call for some study on your part, but I will try and make it as brief as possible, without slighting it.

In the first place, it must be understood that iron is the same always. There is only one iron in the world, and the iron which falls from the heavens in the form of meteors is just exactly the same as the iron which was here before it, but pure iron is not in use, and it depends on what impurities or foreign matter is alloyed with it, what grade the commercial iron used will belong to. With this in mind you will see that the contention of your manager is correct, providing he can back up his assertion that the stove was made of better metal than the machine casting. If a piece of stove and a piece of machine are poured from the same ladle of melted iron, the stove casting will be harder and closer grained than the machine piece, because it cooled quicker, but this has no effect on its chemical analysis; they will both be the same when melted again. This is well known by metallurgists, yet they will say to use stove plate to close the grain on a casting which requires to be exceptionally close-grained. This is an absolutely mistaken conception, as stove plate has no effect, good or bad, on the grain. Chunky iron is the most profitable for the foundryman to use because it does not lose weight in melting to the same extent as thin scrap. Every time a piece of metal is melted it loses some of its weight through oxidization. This takes place on the exposed surface of the iron as will be seen at the blacksmith's anvil. Every time he brings out a piece of hot iron he strikes it on the anvil and knock off a scale of oxidized iron which has formed on the surface. This same thing takes place in the cupola, every piece of iron which is being heated has this scale formed on it, which reduces its weight and a thin piece such as stoveplate will lose vastly more in proportion to weight than a chunky piece on account of its greater surface. Stove plate generally burns away about 20 per cent. of its weight in melting. This, coupled with the fact that a stove generally contains a lot of ashes and stove polish, which all counts on the scales, but not in the cupola, and also that a stove is all bound with wrought iron rods and sheet iron linings to the doors and that a considerable quantity of good iron is lost in breaking up the stove and a lot of extra time is required to handle a given quantity of stove scrap to what would be required for the same quantity of heavy scrap, all combine to make stove plate undesirable unless bought very cheap. It has never been my experience to find stove shops using any better grade of iron than is used in other shops. Most foundrymen prefer heavy scrap because when broken it appears to have a coarser, softer grain, but as I have shown, this counts for nothing as this same metal would have made a close, hard grain if poured into a thin piece.

Now if you have absorbed all of this your last question is answered—chilling a car wheel has absolutely no effect on castings which will be made from it later on. The iron from which car wheels are to be made must be of superior quality, low in silicon and low in sulphur and as a consequence, high in carbon. Chilling the wheel has no effect on the iron; it simply acts on the carbon contained in it, and all it does to this is to prevent it from freeing itself, which it would do in a few minutes if allowed to. If the casting is analyzed it will be found that the rim is high in combined carbon while the hub will be high in free or graphitic carbon. When re-melted these will be as they were originally. Car wheel iron is suitable for any heavy casting, but being low in silicon is apt to chill from the moisture in the sand of the mold if poured into light castings.

In conclusion I will mention a couple more points regarding scrap iron, particularly that of stove. Sulphur in excess of .031 is injurious to iron, and the grates and fire-box of a stove which have been heated to a red heat over and over again will not only be oxidized but heavily charged with sulphur. This part of the stove should always be put aside for low-grade work. My other point is regarding what transpires inside of the cupola when the blast is on. I have been asked on different occasions how I know that a scale forms on cast iron in the cupola the same as it does on wrought iron in a forge. In answer I will say that, theoretically, I assume it; in practice I have experimented and proved that light iron carefully weighed does not produce as much melted metal as an equal amount of carefully weighed heavy scrap. I have also examined scrap which has come down with the "drop" when the bottom was dropped. Any scrap which was heated to a red but not melted has a scale on it.

MOLDING SAND RESEARCH COMMITTEE HOLDS IMPORTANT MEETING

The Molding Sand Committee recently organized under the auspices of the National Research Council and American Foundrymen's Association held an interesting meeting in the Engineering Societies Building, New York, on December 9. This was the first meeting of the whole committee.

Hundreds of thousands of tons of molding sand and core sands are used annually in the iron, steel and nonferrous foundries of America. A large proportion of the expense involved is in the transportation of such sands and handling of the same in the foundry. A little of it is reused; much more might be. Moreover, sands are not always correctly selected for specific purposes. Mixing and other treatment can secure improvement.

Under the direction of the Division of Engineering, N. R. C., and the American Foundrymen's Association, a valuable digest of literature has been made by Professor R. E. Kennedy, of the University of Illinois and distributed to the members of the committee and others interested. Practical foundrymen regard this as a most important treatise on the subject.

Three sub-committees are actively at work. The sub-committee on Standard Tests has reached agreement on six tests which will show the properties that are most indicative of satisfactory working conditions of the sand in almost all lines of foundry practice. The "fineness" test and "cohesiveness" test were reported as the two tests which should be given first consideration. Tests for permeability, water content, and thermal properties, and rational and chemical analyses, should also be considered in a general study of molding sands. The American Society for Testing Materials is to be invited to appoint representatives on this committee to help standardize the methods of making such tests.

The sub-committee on reclamation of old molding sands and greater use of old sands in molding and core-making operations, is preparing a questionnaire for submission to the foundries, which will bring out the proportions of sands reclaimed and the methods of reclamation.

The sub-committee on synthetic sands will confine its attention at first to mechanical means for mixing.

Under the guidance of Professor H. Reis, of Cornell University co-operation will be secured from State Geologists and the Director of the U. S. Geological Survey, in making a thorough survey of sand deposits in this country that are suitable for foundry use.

The co-operation of men having like interests in Canada, England and Belgium, has been secured.

Mr. R. A. Bull, Spondly Building, 639 Diversey Parkway, Chicago, Illinois, has been elected chairman of the Molding Sand Research Committee, and Professor R. E. Kennedy, 909 West California Street, Urbana, Illinois, is secretary. — Wm. Spraragen, Secretary, Division of Engineering, N.R.C.

BEFORE THE DAYS OF THE SHOWER-BATH

When I think of the towel—the old-fashioned towel.
That used to hang up by the cupola-room door
I think that nobody in these days of shoddy
Could hammer out iron to wear as it wore.
The boy who first used it, the tramp who abused it
The melter who used it when these two were done.
The molders, the foreman, the super' (poor man)
Each rubbed some grime off, while they put a heap on
In, over and under, 'twas blacker than thunder
'Twas harder than poverty, rougher than sin.
From the roller suspended, it never was bended.
But flapped on the wall like a banner of tin
It grew thicker and tougher, harder and rougher.
And daily put on a more inkier hue,
Until one windy morning, without any warning,
It fell on the floor and was broken in two.

HERE IS A GOOD FAMILY TO KNOW

The following, from New York Central Magazine, and published by the Ontario Safety League, is really worth keeping in mind—"Have you ever heard of the success family? The father is—**Work.** The mother is —**Ambition.** The oldest son,—**Common Sense.** The other boys are,—**Perseverance, Honesty, Thoroughness, Foresight, Enthusiasm,** and **Co-Operation.** The oldest daughter,—**Character** The sisters are—**Cheerfulness, Loyalty, Courtesy, Care, Economy, Sincerity** and**Harmony.** The baby is—**Opportunity.** Get acquainted with the old man and you will be able to get along pretty well with the rest of the family.

F. H. BELL, Editor

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Technical Journal Devoted to the Foundry and Metal Industries.

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Freak Conditions in Foundry Business

WHEN the lull which succeeded the war began to manifest itself, it seemed to attack almost every line before its effect was felt in the foundry, and when most of the other industries were working short handed the foundries kept on at their regular pace. Now conditions have changed, and the reverse is in evidence. Textile industries and knitting mills are running overtime, while the foundries are practically at a standstill. The most noticeable feature of the situation is that the big manufacturing plants have next to nothing to do, while the small jobbing shop is busy. Another feature is that the jobbing foundry in the small town is busier than the jobbing foundry in the larger centre, the very reverse to what would be anticipated. One conclusion that may be arrived at is that new goods are not being called for, and the amount of repair work which is required is not sufficient to keep the big plant in operation, but is enough to keep the little one busy. A big concern sub-letting work to a small one in the same town may think that they are not getting as good service as can be had from the one in a country town, where expenses are not as high. Thus the little shop in the little town is busy

In London, Galt, Brantford, Hamilton, and similar places visited by Canadian Foundryman, the foundries are just working about one quarter capacity, which is to say, that they have about one third of the regular force of men and are running about four days per week, with some doing even less than this.

There is certainly as much work to do as there ever was, and there is undoubtedly a remedy if it can be figured out. A prominent manufacturer expressed himself in a manner which solves the whole difficulty, and it is the only solution which will ever be a success—"If Canada is ever going to be a manufacturing nation, or an exporting nation, she must first learn to compete in her own home market." Nobody wants free trade, but what is wanted is Canadian-made goods at the same price as goods made elsewhere. It is not much to the credit of Canada to say that we can not compete with other countries. As we have pointed out in these pages on several occasions, there are practically the same number of iron-working industries in Canada in proportion to population, that there are in the United States, or in Great Britain, and as a consequence there is as big a field for each one of them in this country as there is in either of the others, if the Canadian will equip his plant and put the goods on the market at a price which will guarantee him the Canadian market. Henry Ford made his fortune by putting his goods on the market and selling them—not by holding them for bigger prices. The big prices which Canadians get, are not to their advantage, as the raw material for one is the finished product of another, and when a manufacturer pays inflated prices for everything he puts into an article he is obliged to charge an outside price for the article when he sells it, and by so doing he opens the way for imported goods to undersell him. What we want in this country is more conceit. Stop this silly argument that every other race under the sun is our superior and can manufacture more economically than we can. Canada has the best opportunity of any nation in the world to be a leader, if Canadians will only cultivate a little better opinion of their ability, so let's go to it.

Our February Number

THE February issue of Canadian Foundryman will contain a number of interesting articles, among which will be one entitled "Aluminum, Iron, and Electron," being the first installment of a series by Professor Dr. Ing. Hanszel, of Berlin, and published in the Zts. fur Metallkunda, of July, 1921. Everyone knows of the advances which have been made in Germany along metallurgical lines, and while we have just cause for feeling sore at the German we have to acknowledge his ability. Knowledge gained from any source is knowledge just the same, and with this in view this material has been abstracted from the above publication and translated into English, especially for Canadian Foundryman, by Wallace Dent Williams, metallurgist. All reference to weights and measures have been carefully changed from kilograms and millimeters to pounds and inches, for the benefit of those of our readers who may not be familiar with the metric units. The information gained from these articles will be appreciated.

Mr. W. P. Essex, who has been contributing regularly to our columns under the caption "Patterns and Castings," articles mostly of a historic character, but leading up to present-day methods, and who has submitted his initial paper on "Pattern making" in the present issue, will have an interesting article entitled "The Pattern Shop, Some Observations, Experiences and Comments."

Another paper, interesting alike to the pattern maker and the molder, is a continuation of our present article on sweeping propellers, entitled "The Pattern Makers' Part," by Wesley J. Lambert, of Stone and Co., who supplied the British Admiralty with between four and five thousand tons of bronze propellers during the war.

Another paper which will be of general interest to molders and pattern makers, as well as the executives, is entitled "Burning a Patch Into an Aluminum Match-Plate," by A. E. Templar, showing how a seemingly impossible task was easily accomplished when in the hands of a skilful workman.

Our regular page, entitled "In the Foundry," will contain a number of small articles written by practical molders, in addition to cupola practice and core making. All the different departments will be looked after in this number.

In addition to the useful pursuits of the modern foundry we will publish a series of small papers on ancient foundry practice similar to those published during 1921, and which we have been urged to continue. The first will appear in February and will show what was undoubtedly the beginning of metal work—that of making copper tools of the same design as the stone ones which they succeeded. It is the intention to make Canada's only foundry paper more interesting and instructive than ever during 1922, and we invite the co-operation of all foundrymen to this end.

Doors Are Open to Youth

THE RECORDS of men who, starting from humble points, reach positions of exalted responsibility, often read like romances. It is not so spectacular for a person to become president of a large industrial enterprise responsible for large capital investments when wealth or hereditary advantages have placed his feet on high ground from his youth, but for boys to graduate from obscure and minor niches into one upland after another till they reach the top in half a century or less and take seats of the mighty is an achievement as engaging as fiction.

One of the virtues of life in a young and growing country like Canada is that no door is closed to youth if it has sufficient ambition and strength of character. Examples of remarkable attainments have come to the public eye frequently of late and no doubt some of the lads who are to-day working with ladles in our foundries may be captains of far reaching business concerns in the years to come. It is the boy who thinks while he works and who, to-day, tries to put his foot on a higher rung of the ladder than it was on yesterday who succeeds.

Talk Is Cheap

SPEAKING ON "Canada Within the Empire" at the Empire Club, Toronto, a short time ago, Wallace Nesbitt, K. C., advised against operation of the closed shop. So strongly did he advise against it that he advocated making it illegal, which is to say that if he had his way it would be a criminal offence for workmen to form unions and refuse to work in a shop where non-union men were employed. This coming from a lawyer is pretty rich. The lawyers certainly have one of the strongest unions which was ever created, and if they don't operate on the closed shop system nobody ever did. They certainly have a most formidable fortification protected by law, against opposition. A foreigner might be ever so well versed in our laws, but he cannot practice in opposition to our lawyers unless he belongs to the organization.

Our organized lawyers even go so far as to lodge protests against any one outside of their ranks holding the position of police magistrate. In fact our organized lawyers, like all other humanly controlled institutions, are doing everything in their power to feather the nests their members.

Organized labor makes its mistakes and quite frequently makes itself a nuisance, but it is their own affair if they see fit to quit work. They can not prevent the boss from running an open shop, providing he can get the men, but it is hard to figure out how any constitutional law could be made to compel union men to work with non-union men unless they feel so inclined. The union has no hold on the individual man who prefers to break away from it.

It would be a nice world to live in if everybody was good enough to live right, without protection or organization, but it is doubtful if we would require any lawyers under these circumstances. As it is there is only one thing to do and that is just what we have been doing.

Lawyers, as a rule are a good lot of fellows, but occasionally one takes a mean advantage of a fellow man, because the law allows him to do it. Workingmen are also good fellows, and from the standpoint of honesty and good will, can hold their own with the lawyers, but their financial standing is not always what might be wished for, and in their desperation they sometimes make themselves obnoxious; but the law must not attempt to crush them any more than it does the professional man. Whether or not we agree with the union principle, we can not legislate against labor any more than against organized profession.

Back to the Bible

DOWN in Cincinnati there is an organization known as the "Back to the Bible Bureau" which propose to furnish select Bible quotations for publication in the papers. The idea is, no doubt, commendable and the offer has been accepted by a great many publishers. What this world wants is true religion, but not the substitute which is being handed out in the name of Christianity. If the world would accept the teachings of Christ and live up to them there would be no "ructions" in Ireland; no call for a League of Nations; no need for temperance legislation; no need for a lot of things which our legislators are doing in the attempt to keep us on the right track.

Roger W. Babson says: "The need of the hour is not more legislation; it is more religion."

The Wall Street Journal says: "What America needs more than railway extension is a revival of piety to clean the country of graft, petty and big."

The Manufacturer's Record says: "In the Golden Rule there would be found a solution for every business problem."

These are very nice sentiments when we consider the sources from which they come. The mention of Wall Street and Manufacturer, etc., in connection with religion, makes us think of going to church and seeing a lawyer taking up the collection, but still we believe in Christianity and consider it the only means by which the world can ever be brought to a state of civilization, and if the "Back to the Bible Bureau" is making an effort to bring it about we are with them.

The object of the bureau is to secure the co-operation of editors and publishers throughout the country in an effort to reach the great masses of the people with a helpful and inspiring Bible message, and thus inculcate in the minds of readers a greater reverence for the Almighty and a desire for better things in government and all industrial and social relations.

Their argument is that "Faith cometh by hearing," (A passage from the Scripture). Therefore, the first thing to do is to get a hearing.

To get a hearing the Apostle Paul resorted to the synagogue when in a Jewish community and to the market place when among the Greeks. In a modern community, the place where men go to hear or tell some new thing is neither the synagogue nor the market place, but to the newspaper.

The Gospel must first be published among all nations.—Mark 13:10. Watch for our Scriptural selection in each issue. It has a star to guide you to it.

The gold production in Canada during 1920 amounted to 766,764 fine ounces valued at $15,814,098. Of this total Ontario contributed 74 per cent.

The Alberta Foundry and Machine Co., has been incorporated at Calgary, Alberta with a capital of one million dollars, to manufacture iron and non-ferrous castings and do a general foundry business.

* * *

Hiram Walker Metal Products, Walkerville, Ont., manufacturers of Electric Heat Treating furnaces and Ni Chrome castings are remodeling their foundry and otherwise enlarging their buildings, preparatory to a busy spring trade.

* * *

Mr. W. O. Renkin has become associated with the Hardinge Company, 120 Broadway, New York, N.Y., in the capacity of Managing Engineer of the Quigley Pulverized Fuel Department, since this department of the Quigley Furnace Specialties Co. has been acquired by the Hardinge Company.

* * *

Mr. John J. Cunningham who for many years occupied the position of President and General Manager of the Western Foundry Co., Wingham, Ont., died in Toronto on Tuesday, December 27th. The deceased was well known in Western Ontario and had been prominent as a manufacturer of stoves.

* * *

The International Harvester Co., have resumed operations at their Chatham, Ont., branch, which has been running very short-handed for some time. At this department they manufacture wagons, sleighs and speed trucks, and have a foundry in connection where they do their own casting. Mr. Pat Shea has been appointed foundry foreman.

* * *

The E. J. Woodison Co. of Toronto, announce that a quantity of fire-bricks of all sizes and shapes have been put into stock at their Montreal warehouse, and in the future shipments can be made direct from there. This store house is one that was just recently put into commission, and foundry supplies of all kinds are constantly kept in stock.

* * *

Automobile business has no kick. According to figures received from the city architect's department, Toronto, there were three thousand and seventy-eight garages built in Toronto during the year 1921, which would certainly indicate that there was something doing in the automobile business when this number had to be looked after in one city alone.

Mr. O. M. Rau, formerly Consulting Engineer to the Philadelphia Rapid Transit Co., has now become associated with the Hardinge Company, 120 Broadway, New York N.Y., and will specialize in the handling of Quigley Pulverized Fuel Systems as applied to boilers. This change took place with the acquirement by the Hardinge Company of the Quigley Furnace Specialties Co.

* * *

Mr. H. A. Kimber, formerly of the Quigley Furnace Specialties Co., is now in charge of the sales of the Quigley Pulverized Fuel Department of the Hardinge Company, 120 Broadway, New York, N.Y. This change was made owing to the acquirement by the Hardinge Company of the Pulverized Fuel Department of the Quigley Furnaces Specialties Co.

* * *

Mr. L. W. Marso, who is in charge of the Branch Office of the Quigley Furnace Specialties Co., located at 427 Oliver Building, Pittsburgh, Pa., has now become associated with the Hardinge Company, 120 Broadway, New York, N. Y., and will continue in the Pittsburgh Office under the name of Hardinge Company, but will specialize in the handling of the Quigley Pulverized Fuel Systems, which department has been acquired by the Hardinge Company from the Quigley Furnace Specialties Co.

* * *

Industrial Sand-Blasting is the title of a neat circular distributed by the Pangborn Corporation of Hagerstown, Mich., describing and illustrating their new type "GF" Industrial Barrel Sand-Blast apparatus for small foundries or foundries doing a limited amount of work calling for sand-blasting. The circular also describes to some extent the other equipment manufactured by this corporation, and shows how to sand-blast castings which are too big to go in a barrel.

* * *

The Dominion Bureau of Statistics has prepared the results of a preliminary survey of the manufacturing industries of the four western provinces. It shows that at the close of 1919 there were some 6,599 plants and factories in operation; the capital invested reached $482,498,201 and employees on salaries numbered 13,084, while the number of employees on wages totalled 86. 410. British Columbia appeared as the leading industrial province of the west, with Alberta, Saskatchewan and Manitoba in sequence thereafter.

The Comet Washer Company, London, Ont., manufacturers of washing-machines, churns and pump-jacks, have just completed a new foundry, and contemplate running off the first heat during the week of January 9th. Mr. A. M. Powell is the manager and he states that during the years that he has been in business manufacturing these goods he has worked up a sufficient volume of business to warrant the erection of a foundry. He will, incidently, do a certain amount of jobbing work.

* * *

Canadian Vulcanizer & Equipment Co., London, Ont., are issuing a thirty-four page catalogue of their lines of vulcanizers and vulcanizing equipment. It is a well-illustrated and descriptive book and shows equipment for any size of shop and for different sizes of tire. The illustrations and descriptive matter explain in concise manner all the different procedures in vulcanizing, retreading, polishing, buffing, etc., together with much valuable information on garage practice.

* * *

George W. Kyle, Co., Inc., Grand and Thompson Streets, New York City, are distributing a large and attractive catalogue treating on the line of goods handled by their company, which indicates materials, chemicals and equipment for polishing and electro-plating plants, mill and foundry supplies. Practically everything which is called for in these lines is described and illustrated. In addition, a diagram of a modern plating room is shown together with a series of instructive pointers on plating plant topics. The information re dynamos is particularly valuable.

* * *

The Mack Furnace Company, Chatham, Ont., which started operations January 15th, 1921 in the plant formerly operated by the Defiance Iron Works, report business as being good in their line. They specialize in the "Mack" warm air furnace, and while they are still making patterns, they have already filled a satisfactory number of orders and have booked sufficient business to warrant employing one hundred men by the first of June next. At present they have five floors running six days per week, with the exception of Saturday afternoons. About 25 men are now employed. Mr. H. V. McIntosh is the manager.

Marden, Orth & Hastings Company, importers, exporters and manufacturers' agents for chemicals, oils, and tannins, 136 Liberty street, New York, have sold the good will, trade marks, formulae, merchandising business and merchandise to Hummell & Co., a new combination which is composed of three of the former associates of Marden, Orth & Hastings Co. They will continue to carry on business at the same address as the former company in New York, with a branch office at 310 Congress Street, Boston, Mass., where they are in a position to supply a regular line of chemicals, etc., such as were handled by the former company.

National Engineering Company, 549 West Washington Boulevard, Chicago, Ill., have just issued a neat pamphlet to be known as No. 70. It describes all four sizes of their Simpson Sand Miller, including the No. 0, three feet in diameter, No. 1, four feet in diameter No. 2, six feet, and their new and largest size No. 3, eight feet in diameter. This pamphlet covers a very complete description of the various sizes of Simpson Mixer which they manufacture for any foundry, large or small, making any kind of castings, using it for preparation of facing sand, core sand, and other foundry sand mixtures, as well as for the preparation of daubing for lining cupolas, ladles, ovens, etc.

The Electric Furnace Construction Co., 908 Chestnut St., Philadelphia, beg to announce that the Ford Motor Company have decided to install and have placed an order with them for the largest electric melting furnace that has ever been designed or installed. The KVA capacity of the furnace is 9,000, which is three times the size of any previously installed melting furnace. The furnace is designed with six electrodes and is of the "Greaves-Etchell" bottom conducting type, similiar to those already installed and on order for the same company.

This large furnace will be the principal melting unit of the new battery of electric furnaces being put down at the Ford Company's River Rouge Works.

PLATING AND POLISHING DEPARTMENT

Question—We have contracted to manufacture and nickel-plate a steel cup-shaped article about one inch diameter by one and one quarter inch long, the cup is turned from solid steel and is hardened before going to finishing operation. We have found that polishing costs too much. How shall we proceed to obtain a reasonably good finish on the cup by tumbling?

Answer—In any event it will pay you to attend to all cutting tools used in the process of manufacture so that a smooth surface is obtained by the screw machine operation. This would assist in reducing cost of polishing and also facilitate rapid finishing if tumbling is adopted. To tumble the cups we would advise use of sand and water for first tr roughing operation, add enough soda ash to water to act as lubricant and retard rusting. Rough for about 12 hours, or if cups are scored possibly 24 hours will be necessary. Remove from tumbler, wash free of sand and place in a wooden or wood-lined iron tumbler with alkaline water, treat at same speed for at least six hours; remove, rinse, place on racks or plate in mechanical plating machine rotated at very low speed; the deposit obtained in the machine may be buffed if the duration of plating treatment is not hastened.

Question.—As I have read in your answers to platers annoyed by pitting that this condition was due to lack of metal in their solution, I should be greatly obliged if you would care to give me in your opinion on the following extracts:—

"Pitting upon nickel work........... is usually found upon work .... hanging quietly in a solution with plenty of metal in it, with a good anode surface."

I am somewhat at a loss about this pitting, which I have experienced for a long time in different solutions of nickel, and I am sure that you will greatly assist me in giving the explanation requested.

Answer.—Your reference to the extract above as a comparison to views given in these columns is fully appreciated by the author of the latter. In all literature on electro-plating there probably is no subject upon which such contradictory opinions have been expressed as the subject of pitting. Standardization of nickel-plating supplies, nickel plating solutions, together with uniform methods of operating and maintaining nickel solutions of a given composition would no doubt assist in the compilation of reliable data relative to the conditions favoring pitting and how to avoid such condition. Pitting may occur in a "solution with plenty of metal in it, with a good anode surface." We venture to state that 99 per cent. of pitting of nickel deposits is directly due to the deposition of hydrogen during electrolysis, the remaining one per cent. may be credited to hydrogen carried upon the surface of the work from acid dips or water tanks. We have seen gas bubbles present upon steel emerging from a sulphuric acid dip to the extent of being similar to thin foam. This steel was subsequently rinsed in cold running water and immersed in a cyanide solution (15 per cent) ftr ten minutes, rinsed again in cold water and passed through muriatic acid dip, rinsed again and placed in neutral double sulphate nickel solution, which had never yielded a pitted deposit. The result was as might be expected, a mass of pin holes covering such portions of the steel that held the bubbles before the deposition began. We have investigated cases of pitting when the source of the trouble was apparently the nickel solution, but was found in the cyanide copper solution, gas having remained upon the cathode during the period of transfer from copper bath to nickel solution. In our experience we have successfully dealt with nickel pitting by maintaining a high metallic content and very low acidity. Sometimes nickel sulphate is used to increase the metal strength of the nickel solution and pitting which was absent before, appears on the first batch of work plated after the addition was made. This may be due to more than one condition, possibly the solution is the really important factor to be considered in combating the pitting nuisance. The same degree of acidity or neutrality will not apply to all cases. Other conditions such as temperature, concentration, conductivity, composition and current density each have some bearing on the results. The inclination to increase the rate of deposition of nickel has been instrumental in producing a certain confused mental condition among some platers, and while encouraged by results in a general way they have neglected to duly consider what might be termed a reasonable limit in current densities. Some do not consider current densities, they rely wholly upon the voltmeter and possibly use a greater current strength than they figure on. Nickel solutions which are rich in metal, not supposedly so, but proved to be so by analysis, and which are not acid enough to turn blue litmus paper more than a faint purple, and which are operated at high current densities, with pitted deposits as a result, may be used to produce deposits absolutely free from pin holes by either further neutralization of the solution, or lowering the current density, or both. A nickel solution which is loaded to capacity and worked continuously from the time of its preparation will be more likely to produce pitted deposits than a nickel solution which is electrolyzed with very small cathode for several hours immediately after preparation. We have overcome very serious cases of pitting by increasing the metallic content of nickel solutions, neutralizing the acidity with nickel carbonate and using reasonable care not to exceed the speed limit after the preliminary electrolyzing treatment just mentioned. We would invite your special attention to the fact that the acidity of some nickel solutions is not easily determined; also, that some nickel solutions will pit when absolutely neutral. If you have reduced the cost of polishing by a reduction of operations and now plate your product heavily in order to facilitate a proper finish by buffing, we would suggest that you improve the polishing and decrease the speed of plating, as the heavier the deposit the greater is the effect of pitting. A nickel solution of low metal strength which pits may be made to yield perfect deposits by increasing the metal strength and operating at same current density as before the solution was made. A concentrated nickel solution which yields pitted deposits may be made to produce perfect deposits by operating at lower current density, sometimes a 5 per cent. reduction will suffice, while a 25 per cent. reduction in current may be necessary in some cases. These solutions may acquire a condition after a short period of use, which will permit of appreciable increase in current being employed. With direct reference to the comparison of opinions in question we may add that we do not agree with the quoted statement. We would eliminate the word "usually" and then accept the statement as correct, and advise operating such nickel solutions as described above. We regret to say that no positive cure for all cases of pitting is known. We hope you may obtain some help from this reply and feel free to make known to us the result of tests made along the line indicated. Pitting of nickel deposits is one of the problems which remains unsolved after many years of experiment and research on the part of skilled practical men. Platers have successfully met the trouble in individual plants, but the remedy is not always applicable to cases of apparently similar nature. "Many men have many minds," and as long as nickel solutions are prepared and operated in so great a variety of conditions as at present, there will be very little advancement made in the endeavor to solve the pitting problem. Scientific management of nickel solutions must eventually come, but progress is slow.

Question.—I have constructed a simple rotating plating machine similar in design to those sold by supply firms, the apparatus works very satisfactorily as regards deposits, but I notice that the current at the ordinary nickel tanks is considerably weaker. I have no means of measuring the current and am at a loss to know what to do as the machine has proven a great help in handling small pieces which were formerly plated in trays. Kindly inform me respecting the amount of current usually required to operate a plating machine of the rotating cylinder type.

Answer.—The average mechanical plating machine of the rotating type operating in a nickel solution which contains approximately four ounces of nickel per gallon, the cylinder containing a charge of steel work which fills from one-third to one-half of the cylinder and connected to a five-volt circuit, will usually consume from fifty to eighty amperes of current. If you are not using the entire output of your generator elsewhere or very close to it, the addition of the machine to the circuit should not make a noticeable difference at the still tanks, possibly you have neglected the generator and it is not producing as much current as it otherwise would, or there may be a leakage or ground in the circuit, perhaps the generator is actually over-loaded. Ascertain the real cause by using a testing ammeter which may be obtained from the nearest electrical supply house, correct the cause and then procure a voltmeter and an ammeter and cease working under prehistoric conditions. You will not progress or even keep up with the present trend of plating processes unless you adopt modern improvements more liberally. These instruments are not expensive and will solve many problems for you if you study their uses and employ horse sense in the application of your practical knowledge.

Clouds present varied appearances because they are affected by the degree of moisture in the air; by the changes of temperature; by the direction of the winds; by the height at which they fly from the earth; by the electrical state of the air; and by their positions in relation to the light of the sun and moon.

You Save Repair Bills

By Investing in a

COMB'S

Gyratory Foundry

RIDDLE

The Riddle that Mixes as well as Sifts

It's Portable!
—Hang it Up—
Wherever you Work

Think of the advantages of a Sand Riddle that weighs but 90 lbs.; one that can be easily lifted and hung up wherever your work is!

In crowded corners it works as well as in the middle of the shop. There are no legs to get in the way of the shovel; when run on wires it supplies a whole line of moulders.

Note: Operating costs are practically nil on account of the small H. P. Motor used.

Gyratory Motion is Easiest on a Machine

The Sand Riddle best suited to modern foundry needs is a Riddle which has least chance of going wrong in actual service. Thoughtful men can see, without much difficulty, how this factor is obtained through the Gyratory Motion feature.

The COMB'S RIDDLE operates with true gyratory motion. There are no stops, starts or jerks; always a steady pull in one direction. This accomplishes a double purpose, for beside lessening repair bills it actually doubles the capacity of the machine.

If you want a Riddle that will do the work of ten men—and do it better—choose a Comb's.

Find out all about the Comb's Riddle. There are many exceptional advantages you should know

These machines are manufactured at Toronto and can be paid for "in Canadian Funds."

Any of the agents listed below will be glad to give full information.

Ontario

E. J. Woodison Co., Toronto.
Hamilton Facing Mill Co., Hamilton.
Frederic B. Stevens, Larned and 3rd Sts., Detroit, Mich.

Quebec

Dominion Foundry Supply Co., 185 Wellington St., Montreal.
Mussens, Limited, 211 McGill St., Montreal.
Factory Supplies, Ltd., 244 Lemoine St., Montreal.
Williams & Wilson, 84 Inspector St., Montreal.
E. J. Woodison Co., Montreal.

Strong-Scott Mfg. Co., Winnipeg, Manitoba.

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ANODES, BRASS, COPPER, NICKEL AND ZINC
W. W. Wells, Toronto, Ont.

ARGON
Dominion Oxygen Co., Toronto, Ont.

BENCH RAMMERS
I. Johnson & Son, Ltd., Toronto.

BLAST GAUGES
Clark Blast Meter Co., Gladbrook, Iowa.

BRASS FURNACES
Hawley Down Shaft Furnace Co., Easton, Pa.

CHAPLETS
Wells Pattern & Mach. Works, Toronto, Ont.

CHEMISTS
Charles C. Kawin, Chicago, Ill.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Indiana

CORE MACHINES
American Foundry Equipment Co., New York City.

CORE OVENS
Damp Bros., Mfg. Co., Toronto, Ontario.
Monarch Engineering Mfg. Co., Baltimore, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.

CORE PLATES
Damp Bros., Mfg. Co., Toronto, Ont.

CORE SAND
Benson & Patterson, Stamford, Ont.
George F. Pettinos, Philadelphia, Pa.

CRANES
Northern Crane Works, Ltd., Walkerville, Ont.

CRUCIBLES
Joseph Dixon Crucible Co., Jersey City, N. Y.
J. H. Gautier & Co, Jersey City, N. Y.

CUPOLAS
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.

CUPOLA LININGS
Whitehead Bros., Buffalo N. Y.

DUST ARRESTERS
W. W. Sly Mfg. Co., Cleveland, Ohio.

EDUCATIONALISTS
McLain's System Inc., Milwaukee, Wis.

ELECTRIC RIDDLES
Great Western Mfg. Co.
Preston Woodworking Co.

ENAMEL WARE
Crane Limited, Montreal, Que.

FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FIRE BRICK
Bailey & Bell Firebrick Co., Toronto, Ont.

FLASKS
I. Johnson & Son, Ltd., Toronto.

FLASKS, SNAP
American Foundry Equipment Co., New York City.

Directory of Foundry Supply Houses

The Buyers Directory of Canadian Foundryman was originally intended to contain information regarding lines in the production of which the advertisers actually specialized. We now carry the advertising of leading supply houses, some of whom represent scores of manufacturers, in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the supply houses so we recommend that for all general requirements our subscribers communicate with the supply houses listed below:

The Hamilton Facing Mill Co., Limited, Hamilton, Ont.

George W. Kyle & Co., Inc., New York, U. S. A.

Frederic B. Stevens, Windsor, Ont.

The E. J. Woodison Company, Limited, Toronto, Ontario; Montreal, Que.

FLASKS, STEEL
American Foundry Equipment Co., New York City.
Sterling Wheelbarrow Co., Milwaukee, Wis.
Trussed Concrete Steel Co., Walkerville, Ont.

FLUXES, IRON, BRASS, ALUMINUM, COPPER
Basic Mineral Co., Pittsburgh, Pa.

FLUOR SPAR
Basic Mineral Co., Pittsburgh, Pa.

FOUNDRY ENGINEERS
Charles C. Kawin, Chicago, Ill.
H. M. Lane Co., Detroit, Mich.
McLain's System Inc., Milwaukee, Wis.

FURNACES, OIL
Hawley Down Draft Furnace, Easton, Pa.
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES, GAS
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES COKE
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES ELECTRIC
Volta Mfg. Co., Welland, Ont.

GRINDERS, PORTABLE
A. W. Sainsbury, Ltd.
Cleveland Pneumatic Tool Co., Cleveland, Ohio.

GRINDERS, SWINGING
A.W. Sainsbury Lt., Sheffield, England.

HEATERS
E. J. Woodison & Co., Toronto.

HEATING SUPPLIES
Crane Limited, Montreal, Que.

HOSE COUPLINGS
Cleveland Pneumatic Tool Co., Cleveland. Ohio.

INDUSTRIAL ENGINEERS
H. M. Lane Co., Detroit, Mich.

KAOLIN
Whitehead Bros., Buffalo N. Y.

LADLES
Damp Bros., Mfg. Co., Toronto, Ont.

LADLE SHANKS
Damp Bros., Mfg. Co., Toronto, Ont.

MAGNETS
Dings Magnetic Separator Co., Milwaukee, Wis.

MAGNETIC SEPARATORS
Dings Magnetic Separator Co., Milwaukee, Wis.

MALLETS
I. Johnson & Son, Ltd., Toronto.

METALLURGISTS
McLain's System Inc., Milwaukee, Wis.
Charles C. Kawin, Chicago, Ill.

METAL PATTERNS
Bryant Pattern Works, Windsor, Ont.
Hamilton Pattern Wks., Toronto, Ont.
I. Johnson & Son, Ltd., Toronto.

MOLDING MACHINES
American Foundry Equipment Co., New York City.
Benson & Patterson, Stamford, Ont.
Grimes Molding Machine Co., Detroit, Michigan.
Herman Pneumatic Tool Co., Pittsburgh, Pa.
Osborn Mfg. Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
W. H. Nicholls, Brooklyn, N. Y.

MOLDING SANDS
Whitehead Bros., Buffalo N. Y.
A. MacMillan, St. Catharines, Ont.
Benson & Patterson, Stamford, Ont.
Geo. F. Pettinos, Philadelphia, Pa.
Venango Sand Co., Franklyn, Pa.

OXYGEN
Dominion Oxygen Co., Toronto, Ont

PATTERN MAKERS
Bryant Pattern Works, Windsor, Ont
Hamilton Pattern Wks, Toronto, Ont
I. Johnson & Son, Ltd., Toronto.

PIG IRON
A. C. Leslie & Co., Ltd., Montreal,
Steel Co., of Canada, Hamilton, Ont.

PIPE FITTINGS
Crane Limited, Montreal, Que.

PLUMBING SUPPLIES
Crane Limited, Montreal, Que.

PNEUMATIC TOOLS
Cleveand Pneumatic Tool Co., Cleveland, Ohio.

PULLEYS
Dings Magnetic Separator Co., Milwaukee Wis.

RIDDLES
Great Western Mfg. Co., Leavenworth, Kansas.
The Preston Woodworking Machine Co., Preston, Ont.

SAND
Benson & Patterson, Stamford, Ont.
Dick Sand Co., Franklin, Pa.
George F. Pettinos, Philadelphia, Pa.
Venango Sand Co., Franklyn, Pa.
Whitehead Bros., Buffalo N. Y.

SAND CUTTING MACHINES
American Foundry Equipment Co., New York City.

SAND MIXERS
Frost Mfg. Co., Chicago, Ill.
National Engineering Co., Chicago, Ill.

SAND SIFTERS
Great Western Mfg. Co., Leavenworth, Kansas.
National Engineering Co.
The Preston Woodworking Machine Co., Preston, Ont.

SAND BLAST MACHINERY
American Foundry Equipment Co., New York City.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.

SAND MULLERS
Frost Mfg. Co., Chicago, Ill.
Nationa Engineering Co., Chicago, Ill

SAND BLAST ABRASIVES
George F. Pettinos, Philadelphia, Pa.
Globe Steel Company, Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND RAMMERS
Cleveand Pneumatic Tool Co., Cleveland, Ohio.

SANITARY EQUIPMENT
Crane Limited, Montreal, Que.

SNAP FLASKS
American Foundry Equipment Co., New York City.
Damp Bros., Mfg. Co., Toronto, Ont.
Diamond Clamp & Flask Co., Richmond, Indiana.
I. Johnson & Son, Ltd., Toronto.

SNAP FLASK JACKETS
Damp Bros., Mfg. Co., Toronto, Ont.

STEEL BANDS
Damp Bros., Mfg. Co., Toronto, Ont.

TUMBLING BARRELS
R. MacDougall Co., Galt, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.

VALVES
Crane Limited, Montreal, Que.
Cleveand Pneumatic Tool Co., Cleveland, Ohio.

VENT WAX
United Compound Co., Buffalo, N. Y.

WASH ROOM FIXTURES
Crane Limited, Montreal, Que.

WELDING AND CUTTING SUPPLIES
Dominion Oxygen Co., Toronto, Ont.

WHEEL BARROWS
Sterling Wheelbarrow Co., Milwaukee, Wis.

Why Don't You Write?

HARDLY a week passes that Canadian Foundryman does not receive copies of this paper returned by the postal authorities because of the change in firm names or the address of some whose names are on the mailing list. Sometimes complaints reach us of the non-delivery of mail matter. It is not till the receipt of such complaints or the return of the paper, as the case may be, that we obtain any knowledge of the changes or removals of persons or firms. The adoption of the co-operative spirit on your part by notifying changes would make things a good deal more pleasant for both parties. The MacLean Publishing Co. want their mailing list to be in such shape that they will be able to render the perfect service to their subscribers. There is a lot of valuable trade matter mailed by this company and if you don't receive it well, the fault is entirely yours.

INDEX TO ADVERTISERS

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England.

Vol. XIII Publication Office, Toronto, February, 1922 No. 2

KAWIN SERVICE

IT has always been a logical theory that where an automobile has been built "from the ground up" it can't help being a mighty fine car. The reason of course is that every part is constructed with regard to its relationship to the other parts.

Where a foundry is planned, built and operated according to definite pre-established methods the same is bound to hold true.

These established methods you can use in the form of KAWIN SERVICE—an organization of highly trained men giving you all the benefits gained from 20 years practical experience with foundry problems of every kind.

Think what this means to your business. It means that when you want alterations or new equipment you are guided by the most approved methods known to foundry practice. It means that at all times you have expert advice on up-to-date cupola practice, on the economical purchase of raw materials, on the chemical analysis of your mixtures—in fact on every subject that may arise.

Can you afford to be without this valuable advisory service? So successful has Kawin been with other foundries that you are guaranteed a 100 per cent. saving over and above the cost of Kawin Service.

"Building from the Ground up"

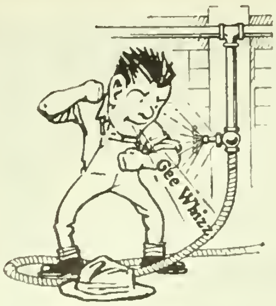
Drop us a line and we will be pleased to explain KAWIN SERVICE more fully. It will in no way obligate you.

Chas. C. Kawin COMPANY

307 Kent Building, Toronto

Chicago, Ill. Cincinnati, O. Buffalo, N.Y. San Francisco, Cal.

Chemists--Metallurgists Foundry Engineers



Jim

Do Your Air Valves Leak?

Well! Go into your shop when the power is shut off and you will hear leaks at every valve.

Jim Says:—Gee Whiz: They are all leakin'—there ain't a Valve in the shop but what is spurtin' air, and ye can't stop 'em—the compressor's workin' overtime and the coal pile is meltin' like a snow ball in June. **Every leak is an extra load on your Compressor, an added pull on your "Coal pile" and a steady drain on your "Cash box."**

Put your "Valve Troubles" up to us—Listen!

Bill says:—"Leaks," there ain't none; we stopped 'em all with **Cleco Valves**—they are all over the shop now—we don't have to waste time patchin' leaky valves, you bet.

Ask us for a sample valve and test it until you are satisfied—then buy some; you can't lose.

Cleco Air-Valves are pressure-seated—the air pressure is always on the large end of "Plug," holding it firmly on seat. No packing or springs used, the air never comes in contact with the seat, therefore no seats to replace—or springs to renew.

Cleco Valves improve with use—they require no attention after installation.

Bulletin 50 illustrates and describes our complete line of Air Valves and Hose Fittings. Mailed on request.


Bill

Cleveland Pneumatic Tool Co. of Canada, Limited

84 Chestnut St., Toronto **337 Craig St. West, Montreal**

WHITEHEAD'S
KAOLIN

Most reliable material for lining and patching Cupolas, Furnaces, Ladles, etc., saves time, labor and firebrick.

E. B. FLEURY

AGENT

1609 Queen Street W.
TORONTO, ONTARIO

ALUMINUM
Brass and Bronze
CASTINGS
in

production quantities
Alloyed to customer's specification.
Jobbing Work promptly executed
Aluminum Match Plates and metal pattern work a specialty.

BRANTFORD BRASS FOUNDRY CO.

22 Leonard Street
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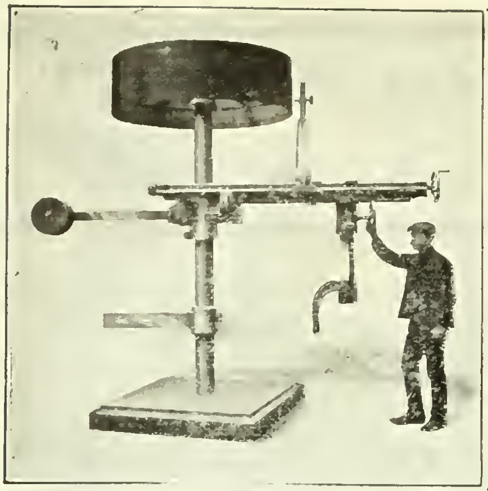


ALL IRON AND STEEL FOUNDRIES
SHOULD BE EQUIPPED WITH

STEWART WHEEL MOULDING MACHINES

WRITE FOR PRICE AND PARTICULARS TO

DUNCAN STEWART & Co., Ltd.

LONDON ROAD IRON WORKS, GLASGOW, SCOTLAND

For Better, Cheaper Castings
First Place in Every Pot—

Try it Free

A Flux for any kind of metal. For BRASS; greatly prolongs the life of your pots and eliminates brass shakes. Clean castings always.

For CRUCIBLE STEEL; gives you better control over carbon, manganese and silicon. Saves ALUMINUM by enabling you to run your castings 15 per cent. thinner. A trial is **proof.** **Write to-day for free trial.**

Thomas Special Flux

The Thomas Special Flux Co.
1052 Norman Ave., CLEVELAND, OHIO.

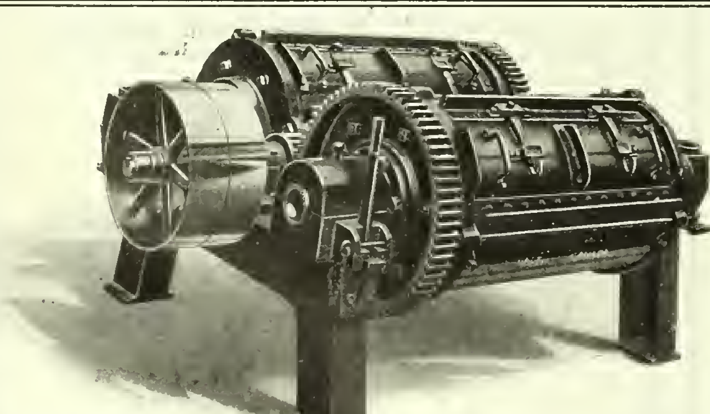
PIG IRON

(ALL GRADES)

FERRO MANGANESE—FERRO SILICON

Stock and Import

A. C. LESLIE & CO., Limited, MONTREAL



EXHAUST TUMBLING MILLS BUILT IN DOUBLE FILE

Constructed in the same efficient manner as all other McDougall products.

Each Mill may be run separately, which proves a decided advantage when filling or emptying.

Properly protected Ring Oiling Bearing.

Guaranteed for Long, Continuous, Satisfactory Service.

THE R. McDOUGALL CO., LTD.
GALT, ONTARIO

Member of the "Audit Bureau of Circulations"

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Established 1909
Published Monthly

Washable White Enameled Foundry Interior

Easily Cleaned if Soiled, but Smoke and Dust do Not Have Much Chance to Take Hold of Smooth Surface—Description of Waterous Foundry, Brantford, Ont.

THE NAME of "Foundry" has always been synonymous with that of smoke and grime, accompanied with foul-smelling gas, which makes the presence of, not only the foundry, but of those who work in the foundry, known for a considerable distance from the seat of the nuisance. This is, to too great an extent, the truth, as a molder can usually be spotted in a street car and allowed surplus seating accommodation, even after supper when he is going up town with his best togs on. A foundry, too, seldom requires a sign to make its presence known. But this state of affairs is not called for, as can be attested by a visit to the foundry of the Waterous Engine Works Company of Brantford, Ont.

In the accompanying photographic view will be seen the interior of a section of this foundry which tells its own story.

Of course this is recognized on all hands to be one of Canada's most modern foundries, and I will consider it as such because that is what it is, but I might easily have substituted "the world's" with equal veracity, as it possesses all the improvements, conveniences, and comforts which the world has so far been able to devise, many of which are to be found in few of the world's foundries. Its heating, ventilating and lighting systems are ideal, but it is not these features that I want to dwell on at present, but on the white enameled interior. This is a departure from the ordinary old-fashioned foundry, and must be considered as a forward step of the most advanced order. Smoke and dust cannot be avoided in a foundry, but their evil effects can be minimized.

The usual programme in the best appointed foundries is to take a few days once a year and clean off the walls with a broom and give them a coat of whitewash consisting of lime and water. This makes them nice and cheerful looking for a short time, but a few heats put them back where they were. Recently a white enamel has been put on the market by the Scarple Varnish Company of Brantford, which is as white as lime, and in addition leaves a hard, glossy surface which can be washed. Two coats of this enamel sprayed on with a force pump at the Waterous foundry several months ago is still as white as the day it was applied. It has never required to be washed, as the smoke seems to get no hold on it. If, however, it should get dirty, the dirt will yield readily to the hose, leaving it as white as ever. The foreman of the foundry demonstrated this fact for my benefit on a section of brick wall and a little bit of dust which was resting between the bricks was washed out, but on the whole the brick faces and the beams and girders seemed to be as white as could be without the washing.

The idea of keeping the interior of the foundry white is an excellent one, because molding is such that it requires the maximum of light in order to see down into the work, and a blackened wall and blackened overhead works are most detrimental to the reflection of light rays, while the white walls reflect the light onto the work and all about the shop.

The Waterous Foundry

A description of the Waterous foundry will be of interest. The old Waterous Engine Works which stood on Dalhousie street was one of the landmarks of Brantford, and, for that matter, of Upper Canada, but the works which now stand on South Market street were erected about a quarter of a century ago. The foundry which was part of the present works was

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later found to be inadequate, while the room was required for other purposes, and accordingly arrangements were made for a bigger and better foundry. Jex street, which occupied ground which was required for the new structure, was moved to a position further north, and the new foundry built as a unit by itself, but abutting the older portion of the plant. It is a building of steel construction, built in with brick, 240 feet in length by 110 feet in width, with two twenty-foot bays. When built it was the intention to leave nothing undone which would contribute to the health and comfort of the men and to the most economical production of castings, all of which has been successfully accomplished.

As will be seen by the illustration, the centre bay is very high, so that the powerful electric travelling crane can be used to advantage on large work requiring a high lift. Above this crane is the lantern, with the windows and ventilating doors. The track for this crane extends out through the east end of the shop for about 100 feet and is supported on concrete buttments and steel uprights, the same as those within the building, and which are in reality a seat of the structural work of the building. Thus a hundred foot extension to the present foundry is already partly built. This end of the foundry was left "blind" with this object in view, and is built in with plank, finished with doors and windows, so that it is not really a blind end. The doors occupy most of the centre bay, and are so arranged that different sized sections may be opened according to the size of flask or casting which is to pass through. These are opened and shut by means of electric motors which are operated by the crane operator from touch-buttons a short distance along the track. The flask storage is under the outside track and when a flask is to be taken out the crane operator touches the button as he passes it, and the doors open and let him pass out with his load, which is deposited in its proper place. In the south bay, is a similar crane but of smaller dimensions, and less capacity. These, with the numerous compressed air cranes, shown attached to the posts, make up the crane equipment.

Cupolas

The melting equipment consists of the two cupolas shown in the illustration, the one with a capacity of twenty tons per hour, and the other somewhat smaller.

Heating

On the upright posts will be seen the radiators, one above another, these, together with the piping along the walls, are supplied wtih the exhaust steam from the engine, and if need be, with live steam from the boilers. This constitutes the heating system.

Core Room

The core ovens are in sizes proportionate with the balance of the equipment. One is so big that the car has to be pulled in and out by power. Two others are fairly large, while a fourth is for small work and has a turn-table system of shelving. The doors on the three large ones are of metal slats and roll up like a window blind. These, with a hammer core machine, a core sawing and tapering machine, and a power-driven sand mixer, constitute the core-making equipment.

Molding Machines

The class of work done here does not call for very many molding machines, but there is one large plain jolter, level with the floor, several small jolt roll-over machines, and an assortment of pulley molding machines.

The other equipment includes pneumatic rammers, sand sifters and in fact everything which goes to make a complete foundry.

The scratch room is located in the building which was formerly the foundry. Besides emery wheels, pneumatic chisels and vise benches, there are different sizes of tumbling mills, one of which is square, and about 8 feet long

White Enameled Interior of Foundry. Waterous Engine Works, Brantford, Ont.

by 4 feet square, with one entire side as a door. Engine beds and similar castings are milled in this machine, being lifted in and out by means of a crane.

Brass

The brass foundry is upstairs over the north bay of the main building. This floor contains, in addition to the brass foundry, which has capacity for large cylinders for fire engines, and various pulp mill castings, the facing sand mixer and most of the supplies for the foundry. Many minor features are of interest. The ventilators are regulated from the floor by turning little cranks attached to the posts in different parts of the shop, while water, gas, and compressed air are piped to the floors. Boiler fronts of the largest sizes are made on match plates in rollover flasks. On the floor where this is done straight edges are fixed permanently into the floor so that when the mold is rolled over onto them it is known with proving that the mold is level and out of wind. In the pits where their standard jobs are done, concrete buttments are arranged for the core prints to rest upon, thus leveling the pattern before it is rammed in, and making a substantial bearing to rest the cores upon. The binder irons are also secured in concrete work.

Lavatory

The lavatory and toilet are in a brick building built for the purpose, and adjoining the foundry. Everything in connection with it is of porcelain, and nickel-plated brass. During the decade in which the foundry has been used it has been considered ideal, but the interior would become blackened and this would not do, and now the white enamel has overcome this difficulty.

While white is essential, there are places where it is not called for. For instance, the radiators might be rendered less efficient if painted any color, and for this reason they are left bare. The arch over the trough of the cupola would burn into some other color if made white, and the bottom of the walls would be dirtied with molding sand unless constantly washed. For these reasons and for the sake of decoration these parts are painted black, as will be seen in the illustration. The large crane is painted red, perhaps to save the operators' eyes when out in the sun. With these few exceptions, the interior is entirely enameled in white, giving it the appearance of a summer garden and removing all the characteristics of the odl-time foundry.

The line of work turned out at this foundry consists of engines, boilers, saw mill, pulpwood preparing and transmission machinery, road rollers, and fire-fighting apparatus.

Mr. Alex. Waldren is in charge of the foundry.

Convention to Meet at Rochester, N. Y.

Rochester, Not Cleveland, Will Be Meeting Place Of The Annual Convention Of American Foundrymen June 5-9, 1922

FINAL arrangements have been made for holding the Annual Convention and Exhibit of the American Foundrymen's Association and allied societies in Rochester, N. Y., the week of June 5, instead of in Cleveland as previously announced.

This decision was reached following conferences on January 18 and 19, with Mayor Kohler of Cleveland, at which time it was learned that due to the incomplete condition of Public Hall, uncertainty as to when it would be open to the public, and the manner in which it would be operated, it would be impossible for them to give a lease for any specific date in 1922. And further, that because of these conditions the present administration could not honor the agreements which the previous administration had entered into with the American Foundrymen's Association.

Rochester Unanimous Choice

Prompt consideration to other locations was given. The Convention Bureau of the Rochester Chamber of Commerce had previously extended a cordial invitation for this year's meeting, backed by assurances of 100% support on the part of Rochester foundries and other civic bodies. All these were promptly reaffirmed by Rochester with the result that this city, which has been given favorable consideration for several years, was made the unanimous choice of the Convention and Exhibits Committee, and of the Board, for a convention the week of June 5.

Splendid Accommodations

All the activities of the Association will be centered at Exposition Park, Rochester's million dollar show place, located only a mile and a half from the center of the city. Comfortable and commodious assembly rooms for general and auxiliary meetings are available while buildings Nos. 3, 4, and 5, all directly connected, afford better accommodations for all classes of exhibits than have been found in any other city where exhibits have been held.

Rochester's geographical location is good, being only a night's ride from all points in New England, and as far west as the Chicago district, and as far South as Cincinnati, Washington and intervening points, and convenient to points in Canada either by rail or by boat from Coburg, Ont., direct to the port of Rochester, making it a central meeting point for the foundrymen of the east, west, north and south, where they will gather together to discuss problems of great interest and value to all. At the Exhibits the western manufacturers of equipment will have an opportunity to meet the eastern buyers, and western buyers will meet half way the eastern manufacturers and dealers.

Rochester would have been first choice for two previous fall conventions had they been able to offer a greater number of hotel rooms. For a June Convention it has been possible for them to increase their guarantees, and the committee feels certain that all members and guests can be comfortably taken care of. A plan is being worked out for handling all reservations through a hotel committee, to which each hotel has pledged a large quota of rooms; reservation and application blanks with complete information will be issued as soon as the hotel committee is organized.

Attractions

Rochester and the surrounding country has many attractions for the tourist and autoist, and June is a beautiful month in this section of the country. Every foundryman should correct his convention memo on his calendar and reserve the week of June 5 for profit and pleasure in the City of Rochester.

AMERICAN FOUNDRYMEN'S ASS.
C. E. Hoyt, Secretary

CANADA'S NATURAL RESOURCES

Attention is now being directed towards the country's natural resources, as never before, since it is generally recognized that only by a more widespread utilization of Canada's undeveloped lands mines, forests, waterpowers and fisheries can present day economic problems be solved.

The Natural Resources Intelligence Branch of the Department of the Interior has published a map showing the leading natural resources of each province. In Nova Scotia mixed farming, mining and fishing predominate; in Prince Edward Island fur-farming and agriculture. New Brunswick has large areas of timber, while mixed farming and fruit growing are outstanding interests. In Quebec may be found a wealth of timber for pulp-wood, also minerals such as asbestos, graphite and molybdenite, while in Ontario somewhat similar opportunities exist.

In the Prairie Provinces the prospective settler or investor may obtain adequate returns on capital and labor in either grain growing, mixed farming or ranching, while in British Columbia timbering, fishing, fruit-growing and mining are among the leading industries.

In addition to information on natural resources, the map shows all railways and trade routes. An interesting and valuable feature is a series of comparative diagrams illustrating the production and exports of the various provinces. A copy of the map may be obtained free of charge upon application to the Natural Resources Intelligence Branch, Department of the Interior, Ottawa.

Burning a Patch into an Aluminum Match Plate

A Seemingly Impossible Task Easily Accomplished When Proper Methods Are Adopted—Aluminum, Though Difficult To Solder, Yields Readily To The Burning Process

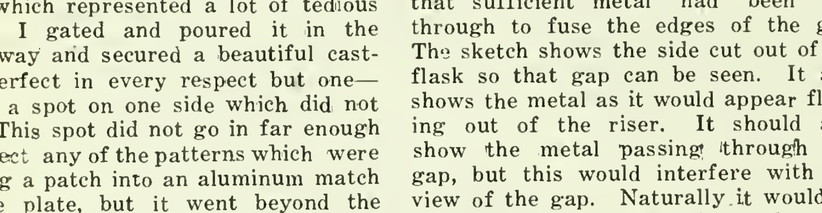
By A. E. TEMPLAR

BURNING A PATCH

THE METHOD which I used in burning a patch into an aluminum match plate that had chilled and run short is an old stunt which I have often employed in casting brass patterns on to a runner of brass, or making a brass or bronze casting with an iron bolt cast into it. It is a possibility, but I had never attempted or even thought that the same idea could be satisfactorily worked with aluminum. However, I was up against the proposition of doing this very thing or of standing quite a big loss.

I had made a fairly large sized match plate with a lot of complicated parts to it, which represented a lot of tedious work. I gated and poured it in the usual way and secured a beautiful casting, perfect in every respect but one—it had a spot on one side which did not run. This spot did not go in far enough to affect any of the patterns which were burning a patch into an aluminum match on the plate, but it went beyond the joint of the flask, and, of course, could not be used in that state. I could not see my way to scrap it, but since it had to have that gap eliminated or else go to the scrap pile, I decided to make a try at it.

The gap was in the middle of the long side and extended well into the plate. A few shovelfuls of sand were thrown on the floor and struck off true but with one side slightly higher than the other. Onto this I bedded the plate with the gap on high side in a similar manner to the sketch which I have shown. The plate was sunk to its thickness, or in other words the sand was built to the level of the top of plate not as shown in the sketch which is intentionally left low so that the reader may see how I placed the sprue. A cope was rammed in a small iron flask into which was cut a sprue and riser as shown. The sprue as will be seen is placed half on the plate and half over the gap, while the riser is on the opposite side. I might say that before placing the plate in the sand I ground the edge of the defective part until it was shaped like the letter V which gave the melted metal which was poured past it a better chance to cut into the solid metal of the plate and make a perfect amalgamation. The aluminum was melted quite hot and poured fast at first, slowing down when it was thought that sufficient metal had been run through to fuse the edges of the gap. The sketch shows the side cut out of the flask so that gap can be seen. It also shows the metal as it would appear flowing out of the riser. It should also show the metal passing through the gap, but this would interfere with the view of the gap. Naturally it would be expected that the melted metal would take the shortest route from the sprue to the riser, but this is not what would take place in a case of this kind. By having the sprue and the riser with cross-section area greater than that of the gap in the thin plate and keeping the sprue full the gap would be flooded all the time and the metal will, of necessity, travel through the gap at a faster than through the space. As the metal enters through the sprue it strikes the portion of plate on which it stands cutting this away to begin with and ensuring a good union there. As it travels at high speed past the sharp V shaped edge of the gap it soon melts that and unites it with the melted metal so that when pouring is stopped the gap is full of metal and the union perfect.



Burning patch on aluminum casting by flowing melted metal in one gate and out of another.

The experiment was successful and well worth the time spent, for to have patched it by any other method would have been as expensive as making a new plate .

MAKES CLAMPS ON MATCH BOARD

Editor Canadian Foundryman—In response to your request for any "pet" idea that will be useful in the foundry, I am submitting one which, while simple, is, to my notion, worthy of consideration.

Every molder who has worked in many jobbing shops will know that there is a lot of time lost by the molders trying to find clamps for their work. I worked at one time in a large shop in Toronto where the side floor men had to give their clamps to the molders who were working on brake shoes that had to be poured off earlier than the work done in the other parts of the shop. This practice caused a lot of confusion and lost time.

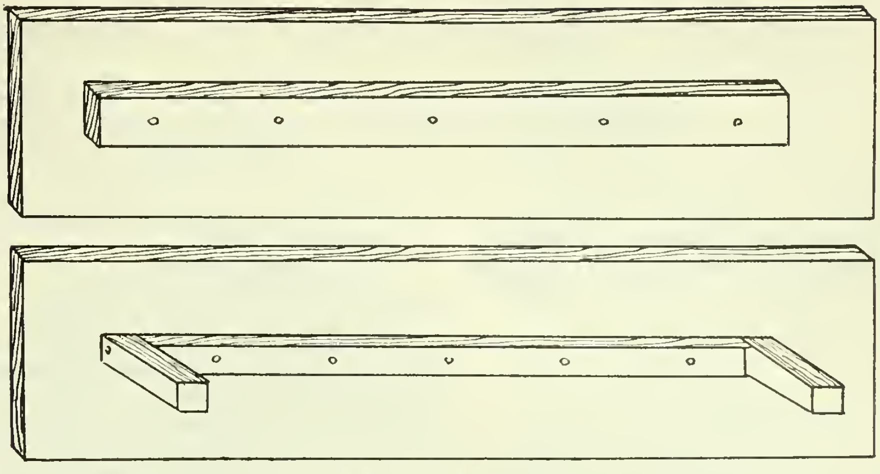
All foundries should have a good supply of clamps of all lengths ready for use at any time,but the supply of clamps is usually short because of the slow method we have had of making them A pattern with the edges battered off and bearing the marks of rough usage, requires a lot of time if we are called upon to make any considerable quantity of clamps, and as a consequence clamp making is generally neglected.

Being in a hurry for a quantity of clamps at one time I thought that if I put the pattern on a board I could make them quicker than by the old way. I did so and it was a great success.

Afterwards we had clamp patterns from ten inches to nineteen inches put on boards with the result that a man could make two or three dozen in less time than it had been taking to make a half a dozen by the old method.

A molder can level off what sand there is left at the end of his floor if he has a half an hour before the wind is put on, and if he is willing he can take the match board pattern and knock down a quantity with ease in a short time, and there will soon be enough for all who need them.

The pattern is made very easily as will be seen by the sketch. The clamp may be fastened to the board by the back as shown or it can be with the side to the board. It might be advantageous to put several patterns on one board, but I have never considered it really worth while.—*Henry Symons*



Bottom view shows clamp fastened to match board. Top view shows handle for lifting out the pattern.

A WELL PLEASED SUBSCRIBER

Mr. J. A. Darrow, of the Darrow Iron Works, Tilsonburg, Ont. in renewing his subscription writes as follows.—"You will find enclosed $2.00 same being amount due you. I certainly do enjoy reading Canadian Foundryman and appreciate the many good pointers we get from its pages. Long life to it."

Reclamation of Metal from Brass Refuse

How the Metallic Portion of the Refuse of a Brass Foundry Can be Reclaimed With Considerable Financial Profit.

By F. L. Wolf and G. E. Alderson

The reclamation of metallic from slag and sweepings is a subject of vital interest to every brass foundryman, but the first cost and interest on investment often make it prohibitive for the small foundry to enjoy the benefits of a complete concentration unit. However, the cost of such an installation, as well as the cost of operation of same are often times exaggerated to such an extent, that many foundries dispose of their copper bearing refuse at a great loss. This paper gives the actual costs together with the returns obtained in the reclaiming plant now in use at The Ohio Brass Company.

This plant is divided into two distinct sections, i. e., preliminary treatment and concentrating department. In the former are the screening, crushing and hand-picking operations, where-by most of the non-valuable constituents as well as the heavy metallic are removed. The concentrating equipment consists of elevator, bins, jigs, ball mill, and table.

Preliminary Treatment

In general, material is classified as slag or sweepings, each having its own preliminary treatment. The foundry slag is first screened, the oversize crushed in a Hill cinder mill, the heavy metallic riddled out of the mill product, and the balance added to the undersize from the first screening. This material is ready for concentration. The sweepings are screened to remove the cores, wires and heavy metallic for hand picking and the undersize is again screened over a 20 mesh, the coarse product going to the concentrator and the fines to waste.

Concentrating

Material for concentration is charged by elevator into a steel hopper from which it is automatically fed to a set of Woodbury jigs. Two classes of concentrate are taken from these, a fine or hutch product which passes through the screens and downward against the water pulsations and the coarse or screen concentrate which is taken off at the level of the screens. The tailings pass to a Hardinge ball mill, and the fine pulp from this forms the feed to a No. 3 Deister table. Tailings from this table average 7 per cent. copper, over 50 per cent. of which is in the form of metallic finer than 150 mesh. All water overflows to a sump and is re-used.

The concentrates from the jigs are caught on screens set over tanks, the water discharged with them serving to wash the metallic very clean. Both table and jig concentrate must be dried out and passed over a magnetic separator. The former average 55 per cent. metallic and the latter 80-90 per cent. metallic.

Production and Costs

Each ton of metal melted in a Swartz furnace produces about 140 lb. of slag. The Steele-Harveys produce 50 lb. slag per ton of metal. By the preliminary treatment approximately 450 lbs. of metallic are recovered from a ton of slag at a flat cost of $3.50. The concentrating plant recovers another 400 lbs. at an additional cost of $4.50. In other words over 800 lb. of metallic are recovered from each ton of slag at a cost of $9.00 for power and labor.

Floor sweepings accumulate at the rate of about 160 lb. per floor per day. After coarse screening, over 100 lb. of metallic can be recovered by hand-picking in addition to wires and nails. The fine screening eliminates more than 65 per cent. of the total burden as non-valuable. The cost of treatment, including concentration, is under $5.00 per ton, and the recovery yields approximately 200 lbs. of metal.

The cost of concentrating alone is $5.67 per ton.

The net metallic recovery on all material coming from the foundry is 98 per cent. and the average flat cost is $5.46 per ton.

The cost of a similar plant, exclusive of housing and erection would be about $6,000.

Conclusion

The fore-going shows that the returns on a plant of this type are far in excess of the costs, even after such items as overhead, depreciation, interest, rent and upkeep have been properly charged. This end is attained primarily through the removal of the large burden of low grade material by cheap screening methods and this in turn is based upon the fact that foundry spillings are seldom smaller than .03" in diameter, i.e. a standard 20 mesh screen.

While this plant has been doing satisfactory work we realize that there is still room for improvement. At present, work is under way to ascertain results obtainable from eliminating all material under 10 mesh from the jig feed. The fines are bi-passed to the Hardinge mill and thence to the table. Indications point to a cleaner jig concentrate and a lower operating cost.

A NEW MINERAL DISCOVERED IN ALASKA

A Washington dispatch announces that a new mineral has been found in Alaska, to be known as "Gillespite." Waldemar T. Schaller of the United States Geological Survey has just announced tests on the new mineral, which was discovered in a glacial deposit about one hundred miles southeast of Fairbanks, Alaska, by Frank Gillespie, a miner of Richardson, Alaska. It was a striking red color and a mica-like structure. Chemical tests show it is a silicate of ferrous iron - barium. (Ferrous iron may be a special brand in Alaska, but it is the only brand elsewhere). It is declared th there does not seem to be any group of minerals to which "gillespite" is closely related.

Pattern-Maker's Part in Sweeping a Propeller

Method Adopted By British Firm—How Pattern-Maker And Molder Co-operate On Work Done Without Complete Pattern

By F. H. BELL

IN OUR last paper on propellers we showed how to sweep up the nowell part of the loam mold and form the blades, which were filled with sand and struck off smooth, preparatory to making the cope. Making the cope is the simplest part of the mold and will not necessarily be explained at present, the pattern-maker's share in the work leading up to what we have already shown will be of more particular interest to the molder as well as to the pattern-maker. Had we explained the pattern making first it would have been hard to understand, not knowing what was being aimed at. Now that we have seen the mold made, the reader, by following the pattern making as I will endeavor to describe it and also keeping his mind on the mold as described in last month's paper, should be able to understand both the pattern making and the molding better than if either one had been studied by itself.

The mold described last month was essentially correct but there were many points not touched upon, such as means of binding it together when the cope is returned for the last time; means of drying mold, etc.

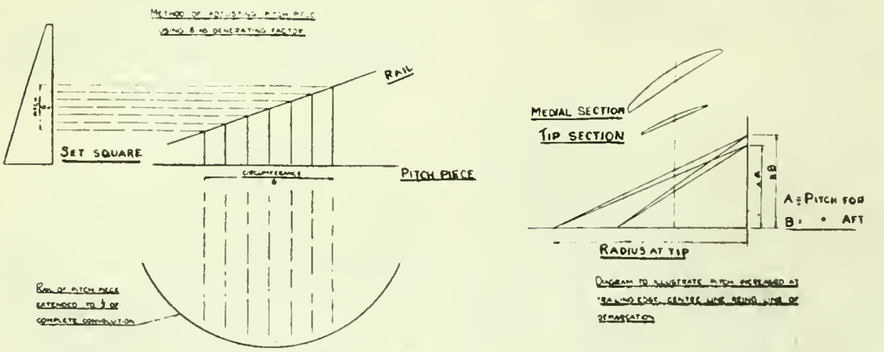
The following pattern making article, extracted from a paper read before The Institute of Marine Engineers of Great Britain by Wesley J. Lambert of the firm of J. Stone and Co., Limited, who supplied the British Admiralty with between four and five thousand tons of bronze propellers, capable of transmitting some 14 million horsepower, during the war, should be easily followed.

The Pattern-Maker's Department

All the necessary data—dimensions, curved radii, etc., are given in the specification drawings furnished to the pattern-maker. From these data the pattern-maker can draw a full-size elevation of the blade and the boss, or the blade and the flange, as the case may be; and he can construct accurately all the pieces of apparatus required, which are enumerated below.

Full-size Elevation Drawing

The elevation is set out on a suitable board, by use of a contraction-rule for iron, gun-metal, or manganese-bronze, which are found to require a contraction allowance of one-eighth of an inch to the foot. The contraction-rule is not, however, used in drawing the thickness of blade sections, which have special allowances. This full-size elevation enables the patternmaker to test the accuracy of the striking-board, boss-board, section-pieces and pitch-templates before sending them to the foundry.



Pitch-Piece

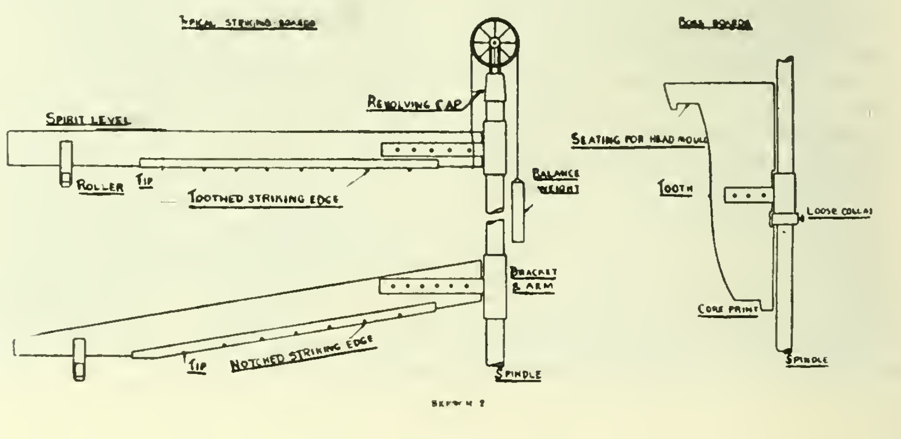
This consists of an adjustable curved construction. It has a strong wooden base, with right-angled uprights supporting an inclined rail, usually made of teak or mahogany—the whole piece being firmly bolted together. The rail is so mounted as to correspond with the pitch, that is, its upper face traces a portion of the helical curve, at a known radius, of the propeller to be manufactured. The radius of a pitch-piece depends upon the diameter of the screw to be constructed, and it is advisable to have a stock of pitch-pieces with various radii.

In adjusting the inclination of the rail it is necessary to use a common factor of both pitch and circumference: this factor is usually 1-16 because thus the radius cuts off a segment containing approximately a sixth part of the total circumference. Thus if the pitch be twelve feet, the rail will rise two feet in moving round one sixth of the projected circumference of the pitch-piece. This inclination is adjusted by means of a set-square of a height of about one-third of pitch, and marked off according to the above factor. The length of the rail is usually a little more than that of the pitch-piece diameter; for example, if the radius be five feet, the rail will extend from ten to twelve feet, allowing ample bearing for the edges of the mold. (See sketch 1). If a blade has a varying pitch, it can be allowed for according as the variation is from leading to following edge, or from root to tip. If the former, the line of demarcation usually lies along the center line of the blade, and this may be adjusted on the pitch-piece; if the latter, a supplementary striking board, hinged to the main board at the point where variation begins, may be used, running on a supplementary pitch-piece of lesser radius; or else the heel of the mold must be knifed away or built up by templates to the required pitch.

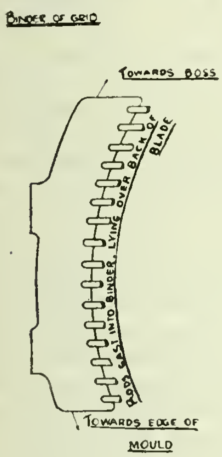
Striking Board

By referring to sketch 2, we see the striking board which is the piece of apparatus that generates the helicoid surface.

It might be explained before proceeding further that while the propeller described in our last month's article was made with the faces of the blade up, and the thickness of the blades cut into the nowell, this is not the most common way of doing. Our next article will describe making it with the face down and with the thickness cut into the cope. The piece I described as being screwed to the bottom edge of the striking



board will therefore not be required. To continue our story, the striking board consists of a board, to which a metal striking edge is fixed, and extends from a spindle, (representing the propeller axis) around which the board revolves, to a distance of about six inches beyond the rail of the pitch-piece; this extra length of six inches gives additional leverage to the molder. The board is suitab'y reinforced by a strong girder of hard wood to prevent sagging or warping, and the striking-edge is notched or dentilated to mark the position of the sections on the bed—notched for fine section-pieces, dentilated for wooden section pieces. A bracket fitted with a metal roller, is attached to the board, the roller running upon the rail of the pitch piece; worn rollers must never be

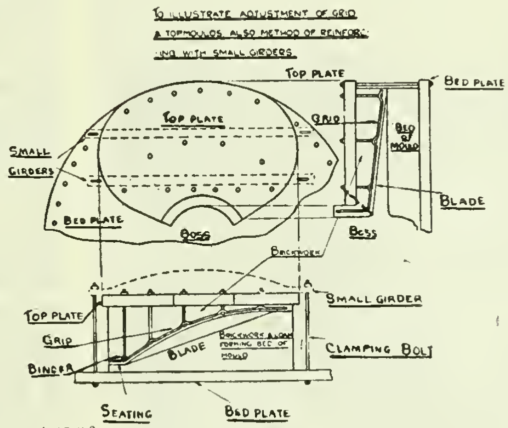


use as they cause small but very troublesome variations in pitch. The striking-edge is usually 1-16 inch iron or mild steel plate; great care must be taken to ensure that the striking edge is absolutely radial to the center of the spindle. In some rare instances the center line of the blade is set off from the center of the spindle and the center line of the flange, running parallel to the radius. In such cases a wooden block of the required thickness is placed between the board and the arm of the bracket which works on the spindle. The top of the striking-board should be quite parallel to the striking edge, so that a spirit-level may be used when bo'ting the board to the bracket arm at right-angles to the axis of the spindle. Sometimes a blade has a "drop," that is, its centre-line forms an angle of less than 90 degrees with the axis of the screw, looking aft; this "drop" is designed to shorten the length of shaft between the propeller and the ship's counter, so that blades of large radius can work at safe distance from the curve of the stern. In such cases the striking-board has a corresponding inclination, so that a conical helicoid surface is generated. The drop of the board may be tested by the use of a spirit-level supported on a wooden template cut to the angle of inclination.

The striking-board for the boss (known in Canada as the hub) is not shaped to represent the finished contour of the boss, because it would be impossible to cast such a shape without risk of unroundness in the metal. The striking-edge is wood, not metal; and it is fitted with a small iron tooth, which cuts a groove meeting the center lines of the blade. The boss-board marks out part of the head, the upper part of which is provided for by a separate cylindrical mold. It should be noted that the top of the board must always be its maximum radius.

Section-Pieces

These are made either of zinc-sheet or of wood. Their dimensions are determinable, from the drawing, but certain very important allowances have to be made, including those for shrinkage, machining, distortion, and thin edges.



Sketch 3.

Flange-Pattern

This concerns blades which are to be made separately and bolted to a boss. The pattern is made of wood and resembles a segment of a solid sphere based on a thick disc; the bolt-hole recesses are cut away as required. It is made with due al'owances for machining and shrinkage.

Templates

Pitch-templates are used for correcting pitches at various radii, or for testiny any variations due to cutting away or building up. They are constructed on the principle that the helical angle increases from the circumference to the center where it becomes 90 degrees. A spirit-level is used to test their position on the bed of the mold. Tilt and fillet-templates of wood for the correct building up of tilt (which is designed to facilitate the flow of water from the root face of blade) or for the cutting away of fillets, where the blade meets the boss, are made to the radii of curves as given in the design print. The radii of fillet curves are least towards the edges of the blades and greatest towards the center-lines.

Core-Boards

Large propellers are always cast with cored bosses. The dimensions of the core are fixed by the pattern-maker, and a striking-board of wood is constructed to enable a suitable core to be struck up. Propellers of less than five feet in diameter are usually cast with solid bosses. The core tapers from the bottom of the mold upwards, that is in a direction opposite to the taper of the finished shaft-hole; the core being made as small as conveniently possible and tapering upwardly to facilitate the flow of metal to the blades. "Lightening chambers" in a boss, are if possible, to be avoided, because they prevent the adequate "feeding" of the metal to the blades.

Continued in next issue

A NEW CORE BINDER

Hunnell & Company, Inc., 136 Liberty St., New York, announce that they are putting on the market a liquid binder known as Mohtan. This binder has been used for years as a preservative for roads, by applying it with a watering cart. As a core binder the following is what is said of it:

Liquid Mohtan can be used for all of the purposes for which molasses, flour, or any of the Vegetable Core Binders are used in foundry work. A gallon of Liquid Mohtan has the strength of from two to three times that of one gallon of molasses.

Liquid Mohtan can be used alone in proportion of one part to sixty parts of sand, or it may be cut into the sand in connection with core oil which really makes the most satisfactory core. Liquid Mohtan being rather heavy should be thinned out before using by the addition of from one to two gallons of water. When used in connection with core oil, the method usually adopted is to cut one part of Liquid Mohtan which has been previously tempered with water, into the sand, then cut in three parts of core oil. This latter method is extensively used in foundries making medium, to large size cores. The advantage of Mohtan Oil Cores is that when making your cast the heat of the metal draws the Liquid Mohtan to the surface of the core, the oil remaining in the interior, making a firm core. As soon as your cast has cooled there will be no difficulty in removing the core as that part of the core containing the Liquid Mohtan, or rather the outer edge of the core will readily crumble, and will not adhere to the cast. If you have been using a Liquid Vegetable Core Binder, the foreman will readily understand this.

Liquid Mohtan is a good green bond for the black compounds, the use of which can be cut in half, making a core easier to clean out, if tempering is done with a solution of about one gallon of Liquid Mohtan to 10 or 12 gallons of water. Good results along this line can also be obtained by cutting in with black compound about 10 or 15% of Liquid Mohtan and then tempering the mix in the usual way with plain water.

THE PATTERN SHOP

Some Instructive Experiences and Comments

By W. P. ESSEX

IN EVERY branch of industry it will be noticed that there are some trades which seem to be particularly dependent on one another, and where co-operation and united effort of the various crafts is most essential to the successful production of the article or product around which their common interests centre. In few industries is this co-operation more necessary, than between the pattern department and the moulding shop of the modern industrial metal plant, that the products of the foundry be, not only perfect castings, but economically and expeditiously produced.

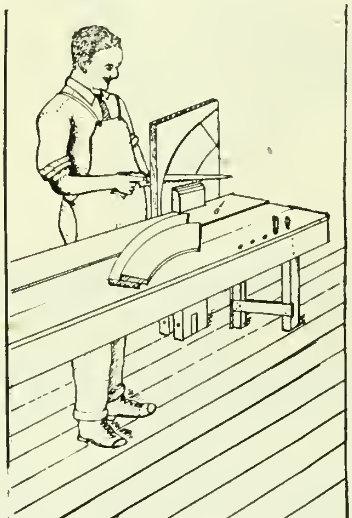
Patternmaking a Modern Craft

The art of patternmaking as it is understood to-day, is a comparatively new craft, not that patterns were unnecessary in the past, or an unimportant preliminary to the moulding and casting of those remarkable bronze creations, that have been so frequently mentioned in these pages, but that the nature of the work, did not admit of an artisan class separate and distinct from the artificers in brass and bronze, who were generally artists in metal, and shaped their own working models in clay or other plastic material, or worked in conjunction with the sculptor in bronze, who modelled in wax the original figure, which was employed as a pattern in making the mould.

Patternmaking and moulding are so closely allied that one cannot be divorced from the other and continue a separate existence, each requires the other's assistance and support. When it is required of the moulder to produce a casting, or a number of cast articles of a definite shape and size, he must be provided with a correct form or pattern, of the article required, and suitably made for moulding, with the necessary allowances for the contraction of the metal and machining, with prints correctly made for the cores' support, and boxes for the making of the cores. And here the skill and resourcefulness of the patternmaker is as essential to the producing of the perfect casting insofar as his work may go, as that of the man, who with ability and judgment, builds up the mould of sand or loam, properly rammed, gated and vented, and securely clamped or weighted, pours into it the molten metal, which when cooled and taken from the mould a sound and perfect casting, represents the resulting efforts of two distinct craftsmen, trained to work in widely different materials, but both working to the one end.

Considerations Shown to the Patternmaker

Not always have the pattern shop and its skilled workers enjoyed the distinction that they do to-day. In the past the pattern shop as a necessary adjunct to the foundry, was in many instances regarded by the proprietor of the works as a necessary evil and expense, which had to be endured, as the foundry and machine shop could not continue for long without their assistance, so the disposition shown towards the patternmaker was a sort of mild toleration, and as a consequence he avoided the boss as much as possible, when the work was slack, but assumed a certain amount of independence when orders were coming in for work requiring new patterns.



Then we cut segments with a keyhole saw.

It is only in recent years that in planning industrial plants provisions have been made for the accommodation of this most important department of the foundry. Before this period very little consideration was given by the management to accommodation for the patternmakers. If the works employed but one, his bench was usually in a corner of the wood-working shop. If there was no wood-working department, then any old place, a remote corner of the machine shop, or the loft above, close to the roof, would do for the patternmaker. Little thought was given as to the suitability of its location, or its equipment, and less to its comfort and convenience.

Some Reminiscences

The writer has in mind just such a shop, one in which he labored for nearly two years, and labored is the most appropriate word to use when referring to working efforts in this shop.

Situated over the machine shop, with a lean-to roof above facing the South, and lighted only from that side, and that overlooking the yards of a railroad it was "some place" in the dog days and a veritable cold storage in the winter months.

The work was of a large and heavy type of H. S. self-oiling, and "Corliss" engines, but the only wood-working machine in the shop was a turning lathe—Yes! there was another, "the band saw?" a contraption built on an upright post where the vibration on the floor caused by a faulty shaft alignment beneath, made the keeping of the saw on the rims of the wheels almost an impossibility, for the slightest twist or bind on the saw caused it to break. Then came the job of untangling the broken remnants from the arms of the wheels, and a trip to the blacksmith shop for a new braze. These operations would be repeated until the saw was too short for further use. Then we cut segments with a keyhole saw.

Suggesting to the foreman one day that a trimmer would be a handy tool to joint segments, he surprised me by saying "We have one somewhere." Questioning him further as to why it was not available for use, his reply was that when he had it set up and tried to keep it sharp and fit for use, the darn molders and others would come up at noon, and cut their plug tobacco on it, and that the only way to stop the practice was to put the dashed thing away, and its hiding place was not revealed.

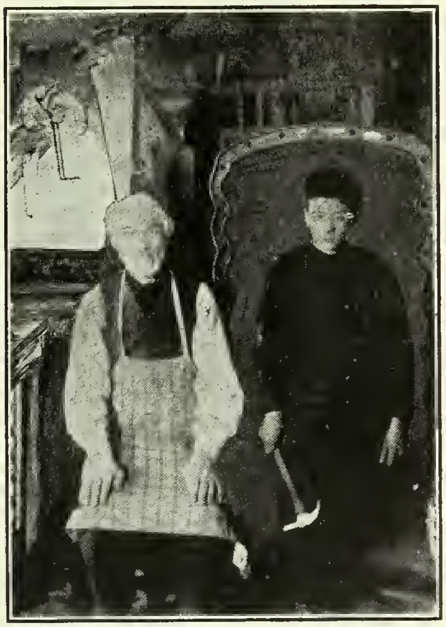
When we started on a new job it meant a trip down the stairs, through the length of machine shop and annex to the farthest end of the yard, to reach the lumber shed. After turning over the pile, and selecting a few doubtful boards, the return trip was negotiated staggering under the weight of a couple of twelve-foot planks. Several of these heavy freighting trips were sometimes necessary before sufficient lumber for the job lay on the shop floor. It was then ripped by hand and dressed with the jack plane. It was hard labor, but after much perseverance and long suffering, a masterpiece of patternmaking art stood in place of the pile of rough lumber.

What an attraction some of those old time patternmaking corners seemed to be to some of the favored and near favored ones of the works organization. The shop apprentice, especially, and the blacksmith, full of big ideas, and always ready with suggestions how to make a difficult job easy, such as a small S-shaped core box for a trap, by bending a piece of round iron to the desired shape, then making it red hot, and burning it into the wood. What a clearing house for ideas of all sorts, and a bureau of general information besides, for the whole works. A regular mecca for pilgrims and wanderers from the remotest parts of the plant. A sort of factory emergency hospital to render first aid to the molly with a scratched finger or a ground nail, who wanted some shellac and a rag put on to keep out the dirt. A rest room for the weary willies of the works, and a rendezvous for the old cronies who just dropped in to pass the time of day, and inquire as to what's doing, but usually stayed until they were given a jolt that moved them on. An intelligence department for the would-be inventor who had a scheme for putting a brake on roller skates, and would like to get some assistance in working the idea out, and some wheels turned to try it.

This description is a true one and not overdrawn, as the sad-eyed ancient man, the genius of the corner from which this picture is taken, would testify, were it not that he has long since ceased to worry over the multitudiuous variety and ever-increasing number of jobs, and thankless tasks that were his while he patiently toiled for employer and employee, with little appreciation or reward from the one, and much less from t'other.

His Work Was of Infinite Variety

The grist of work and the different jobs that usually fell to the lot of these old-time patternmakers, were of infinite variety, and his greatest asset was necessarily versatility, which he was given ample opportunity to display. Sometimes called upon to make a pattern for some machine part or article, which he had possibly never seen and from the most meagre description, without even an outline of what was required, or illustrated possibly with the fingers of an individual who could not make an intelligible line with a pencil. And then he was expected to assume responsibility for the correctness or suitability of the part or article when made. In many of the smaller shops the patternmaker was regarded as a sort of mechanical engineer as well as general wood-working mechanic for the whole works, and burdened with these honors and responsibilities, it is not to be wondered at that he became sad-eyed, stoop-shouldered, and prematurely grey, for as the necessity arose, he was in turn, designer, draftsman, patternmaker, millwright and foundry carpenter, making the flasks, boxes and boards, not forgetting repairs and the wood jigs for the machine shop. Much of the writer's time during his itinerancy as a patternmaker, has been spent in just such shops, and the adventures experienced along the way

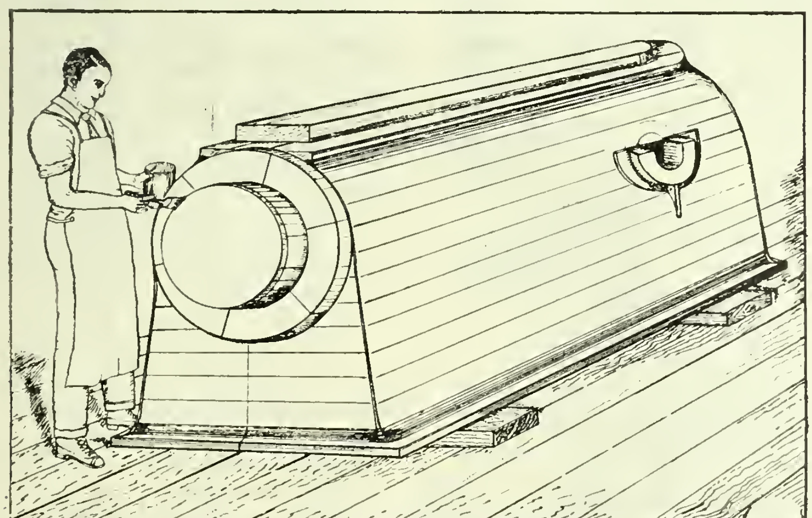


The genius of the corner and apprentice

have been sometimes amusing, but mostly annoying, although generally profitable, not in a financial sense personally, but because of the opportunities they afforded for original effort, and the development of that characteristic known as resourcefulness.

These experiences have also been valuable in clearing away many fogs and mists which had existed in our minds as to the methods and systems employed in the different foundries for producing the many and various classes of work, of widely varying types and materials, such as castings from the different alloys of white metals, brass and bronze castings, grey iron castings, light and medium for various lines of work, chilled cast iron and white iron for hard and malleable castings. The methods employed that have given the best results in the molding of these different classes of work and the practices followed in the making and arranging of the patterns in a manner most suitable and effective for quantity production, as well as the materials and tools used, will be the aim and purpose of the writer in future papers to attempt to describe.

While anyone who can use wood-working tools and can shape the material into definite form, can make a pattern of some kind, it requires special training along with highly developed skill, and an intimate knowledge of foundry methods to become a patternmaker. In these days of trade specialization which has been extended even to patternmaking, the old time "all around" man with all his skill and resourcefulness, could not easily adapt himself to the ways of the organized modern shop.



2) *A Masterpiece of Patternmaking Art. Stood in place of the Pile of Lumber.*

PORTABLE CRANE

A new industrial portable crane has been placed on the British market recently. This crane is electrically operated and can run in and out through the doorways of warehouses and stockrooms and can be placed alongside a motor truck or railway car, that requires to be loaded or unloaded in the shortest space of time. It has a jib type of crane which is mounted on a "runabout" chassis, without the usual turntable arrangements. That is to say, that the crane is rigidly attached to the chassis and always remains in the same relative position to it. Motive power is supplied by storage batteries to electric motors. The two steering wheels can be turned so that the whole crane will revolve by power about its own axis without any motion of translation. The capacity of the crane is 1,500 pounds, at a radius of ten feet in any position in the circle, with a height of hook of twelve feet. The crane is guaranteed to sustain an overload of 25 per cent. The overall width of the apparatus is six feet. It rotates in a circle of 6 feet 3 inches in diameter. The weight, including the drive, is about three tons. The crane can travel at a speed of about 300 ft. per minute and will hoist at a speed of twenty feet per minute, and slews at the rate of 2½ revolutions a minute.

(Continued on page 31)

Research Work on Zinc and Zinc Alloys

Alloys With A High Percentage Of Zinc Replace Brass With Favorable Results—Pressed Zinc A Commercial Success, After Initial Difficulties Have Been Overcome

By WALLACE DENT WILLIAMS

THESE investigations have been carried out by the author during the war, and upon the suggestion of the metallurigical committee of the German Metallurigical Society the results were brought together in this form. The work embraces: Improvement of zinc by pressure and by rolling tenacity and manufacture of pressed zinc—properties and treatment of "Spandauer Zinc Alloy"—Influence of Copper and Aluminum additions—Alloys combined and compressed—Notes about Aluminum, Cast Iron, Electron and other metals to follow.

For the following execution of the experiments with substitute metals as a foundation, the author, during the war, obtained the Committee's authorization. For the completeness of the treatment, no pretension will be raised, since the publication must be left undone in many parts. All substitute metal questions brought up during the war must have found a quick solution, because protracted investigations could not be undertaken. Therefore slumber still innumerable separate questions that had only begun to invade the province of the technique; which could in the quiet times of peace be further explained and solved. For the special peculiarity of the manufactured fuses, which the treated metal was good for, is, for readily conceived reasons, not entered into. Frequently, only the general appearance was discussed, as the industry interested in it individually has already been avowed. The wider publicity of the experiments made at that time, however, should not be kept back, because they are suitable to be made use of generally in many respects.

This interesting paper was written by Dr. Ing. Hanszel of Berlin and published in the May, 1921, issue of Zts. fur Metallkunde, from which it was extracted and translated especially for Canadian Foundryman. It will run into several issues and will be well worth following. The Germans are universally recognized as being resourceful, and when hard pressed for material during the war they developed some wonderful surprises. Aluminum, on account of its low specific gravity, was studied carefully, while zinc, which could be secured when copper could not be, was forced to do service, which it did in a satisfactory manner, thereby opening up new avenues for experimenting and achievements, hitherto unthought of. — ***Editor.***

Brass As Original Constructive Material

The projectile fuses in times of peace were almost exclusively made of brass; only particular kinds of fuses, for ballistic reasons, were made from a light metal alloy of aluminum. In the army factories, in the fire-works laboratories, the projectile brass had a composition of 57 to 61% copper, 1 to 2.5% lead, the balance of zinc and admixtures (up to 0.7% iron to 0.7% silicon) of total impurities, including aluminum, 3-1/2%, in which at first the metal was cast into iron molds into bars of about 0.5 meters long and about 40 millimeters diam. (and more); from these bars sections of certain lengths were cut off, heated to a dull red and under a hydraulic of a mandrel press were compressed into the so-called small crude fuses. Such brass was frequently falsely denoted also as "pressed brass" whilst this mark, in the industry, otherwise was applied to the product made on the lever-press, called by that name, and under various shapes was known to the trade.

By many metallographic and physical tests, during the war, it could be established that the brass made in the army factories showed proportionately high tensile values, but the structure corresponding with the fashioning or shaping of the metal, here and there, differed entirely with the different pressures, as the metallographic slides furnished the evidence, and also that sections cut from portions, the bars submitted to rupture and notch tenacity tests showed great variations in their values. Several test bars made from this material having a diam. of 5 mm and a gauge length of 50 mm, gave the following values:

Resistance to rupture 12.7 to 28.9 Kg. per sq. mm. or 18,064 to 41,106 lbs. per square inch.

Elongation, from 2 up to 6.8%.

Notch bar tests, fractured sectional area 5 by 10 sq. mm (bar of 10 by 10 mm sectional area, notch about 2 mm diam.) gave a shock test of the notched bar equal to from 1.9 to 3.2 mkg per square centimeter.

Since the fuses came in with great pretensions to a uniformity of high tensile stress values, for such purposes only rod brass was used that had been shaped on a lever press and pressed hot into the mold. The favorable tensile properties of this pressed brass may be per-

Table 1. - Tenacity of Brass.

Kind of Material.	Test-bar Diam. by gauge length in mm.	Resistance to rupture. Kg per sq.mm	Elastic limit Kg per sq.mm.	Elongation %	Shock test on a notched bar, in mkg per sq.cm.	Hardness with ball of 10 mm diam, and load of 300 Kg.
1. Bars 42 mm diam. cast in iron mold...........	10by100	33.1	17.8	12.5	2.23	84
2. Cast metal	5by50	15.3-25.5	--	0- 3.6	--	--
3. Metal pressed from a cast bar..	"	20.4	--	16.0	--	--
4. Pressed brass bar 33.3 mm Diam.....	10by100	40.1-44.5	28.6-29.2	43-47.3	5.35 - 6.04	--
5. Pressed brass bar 23.3 mm. Diam.....	"	49.6	34.4	29.1	5.05	113-118
6. Pressed brass bars 7.2 mm Diam......	5by50	52.2-54.8	--	15.0-17.2	--	--
7. Ditto for parts of special requirements (59.2%Cu, 0.4%Pb, 0.2%Fe 40.2%Zn-pure zinc-40 mm diam...........	20by200	40	--	45	9-9.7	--
8. Ditto for special required parts (59.5 %Cu, 0.6%Pb, 0.25%Fe, 39?65%Zn-pure Zn-40 mm diam.........	"	39.6	--	43.3	7.7-8.9	--
One Body { 9. Pressed metal from pressed brass bars.	6by60	38.9	20.3	43.7	5.43	72-82
One Body { 10. Pressed metal from pressed brass bars	"	37.1	23.0	35.6	5.01	73-83
One Body { 11. Pressed metal from pressed brass bars.	6by60	40.6	--	21.3	4.93	74-79
One Body { 12. Pressed metal from pressed brass bars.	"	42.4	--	22.3	6.13	

Table 1.—Showing the tenacity of brass.

ceived in Table 1. With round bars of about 34 mm diam. there was reached a resistance to rupture of more than 40 kg. per sq. mm, or 56,894 lbs. per square inch. The elongation was more than 40%. With thinner bars there was a tensile strength of 50 kg. per sq. mm., or 71,117 lbs per square inch, and an elongation of more than 15% is easy to reach, the metal, therefore, had a high working capacity for quiet loads; also for sudden requirements (Percussion), the important shock tenacity is high. The shock test with the notched bar showed a working capacity of about 5 kilogram-meters per sq. cm. (mkg. per sq. cm.) This brass may be poured hot in hollow forms in any molds with sharp edges and clean surfaces, without a slackening up of the favorable pressing temperature of the metal or altering its tensile properties. With a higher cutting speed, with less wear and tear, it may be worked upon a light dry bed, but in the cutting of long threads, it was necessary to lubricate the cutting tool. Finally the capacity of resistance toward external influences, the stability in the air is so complete, that in no case was a special protection necessary, not even in contact with a powder-charge.

For fuses with particularly great requirements pressed brass with a tenacity inferior at least to the maximum value was used. This decrease was specified:

Resistance to rupture greater than 40 kg. per sq. mm. and elongation greater than 25%, and the composition was to be: 58 to 61% copper, 1.8% lead, 0.5% iron, 0.5% silicon and the balance to be zinc.

The brass was made from particularly pure copper and zinc with an addition of phosphor copper. As a substitute for brass it was of the first consideration to evaluate the great quantity of available zinc. Zinc, however, with its slight tenacity of about 2 kg. per sq. mm., is not suitable on the whole for a constructive material; then only an improved zinc could be considered.

Pressed Zinc

In times of peace, an improved method was used, according to the standard of the pressed brass method. For example, in the production of zinc tubes (Hohenlohe Foundry) in which the zinc is condensed in its structure by the lever-press. Of course the method requires denser zinc bars of 30 mm or upwards, heavy presses of more than 100 tons pressure, and the work must be carried through carefully in order to obtain uniform metal; still, after the initial difficulties, almost all the press-work succeeds with refined zinc with about 1 to 1½% of lead in producing pressed-zinc bars with the stipulated properties.

In Table 2 is perceivable the values reached with the manufactured material; with the material from the firm C. the resistance to rupture fluctuated about 10% from the average values; the elongation is not uniform and varies about 25% above and below. The mean value of the resistance to rupture lies at about 25%, with an elongation of about 40% above the desired minimum value.

With pressed brass as also with pressed zinc, the first requirement of good bars is that the cast round bars (bolts) of about 120 to 180 mm diam. which were put into the press shall be free of faults, hence without piping, slag enclosures or fissures. Therefore the bolts are cast with high gate-heads and in many press-works are spoiled; the pure zinc solidifies in casting to a coarse crystalline structure, and with unequal solidification forms within itself fissured crystals.

Further, on account of the slight tenacity the cast bars are sensitive so that to meet the requirements cracks appear; such cracks and fissures give rise to faulty places in the pressed bars, since the welding together of the unsound places in the reheating and pressing processes no longer takes place. Particularly in producing fine zinc wire as a substitute for copper wire, such faults are observable, and press-work which originally referred to cast bars have these finally cast automatically, in order to make any assistance unnecessary. For such a purpose there is often used a zinc with a fineness of 99.9, in order to avoid by means of the lead accumulation the fracture of the wire caused by it. In the pressing of zinc a proportionately low temperature is used (about 100° to 160°C), and operated with a very slow rate of progress.

In place of the pressure there is also the usual rolling method. With the latter equally good properties are reached. Separate firms possess both bar presses and rolling mills, and prefer to prepress the bars in a bar press from a large diameter to one of a few millimeters and finally to finish by rolling the bars out to the desired diameter. By this means they obtain a uniform tenacity and elongation.

The improvement of zinc by pressure and rolling is so thorough that in contrast to the tenacity values of cast and pressed metal it appears improbable that the same material is being treated. Whilst the cast zinc with its coarse crystalline structure is astonishing with its mirror-like crystal surfaces of more than one centimeter in length the pressed zinc shows a uniformly fine grained structure with a silky luster of a light gray color. In the polished face and fracture the direction of the pressure comes out in distinct flowing lines. The fibrous structure becomes important, neither with the rupture tests nor with the shock tests, a sign that the tenacity does not follow after the fiber as it does perhaps in rolled iron.

As already the improvement of the grain may be conjectured, the tenacity of the pressed zinc in comparison to ordinary cast zinc is astonishingly high. With bars of about 45 mm diameter, the resistance to rupture easily reaches 20 kilograms per sq. mm. or 28,447 lbs. per sq. in., with an elongation of 25%, whereby the metal is suitable for many purposes. The requirements for the decisive percussion shock tenacity tests are to be sure not increased in proportion to the resistance to rupture; on a notched bar the shock test on a comparative bar of 10 by 20 sq. mm, fractured area, gives a value of only 0.5 to 0.7 mkg., per sq cm. As table 2 shows, the hardness number amounts to from 40 to 50 (4mm ball diam. at 50 kg. pressure) and to 55 (10 mm ball diam. at 300 kg. pressure.

In a warm condition, pressed zinc by pressure or by blows of a swaging tool may be brought into shape; with this treatment, however, it is to be observed that sharp re-entrant angles and abrupt sectional changes must be avoided; on account of slight plasticity of pressed zinc the material is supposed to flow everywhere as little and as uniformly as possible; at the points where it suffers the greatest displacement there appears a sponginess of the structure, which chiefly in the vertical reduction of the elongation is made observable in the flow of the metal.

This interesting article will be continued in the March issue of Canadian Foundryman, when it will be well illustrated.

Metal from the Firm.	Composition.			Resistance to rupture Kg per Sq.mm.	Elongation %	Reduction of area %	Impact Test MKg per Sq. cm.
	Lead	Iron	Cadmium				
A	--	--	--	17.7-20.8	32-43.5	--	--
B	--	--	--	17.8-18.8	26.7-29.2	82.7-77.2	0.41-0.53
"	--	--	--	17.1-17.8	23.4-29.2	75.9-95	0.59-0.66
"	--	--	--	18.3	18.3	66.5	0.51
"	--	--	--	17.2-17.9	21.7-22.5	73.2-80.3	0.54-0.63
C	0.86-1.1	0.2	Tr.	22.0-(12)	26.3	--	--
"	0.9-1.02	0.2	Tr.	21.4-(12)	25.4-(12)	--	Hardness
"	0.86-1.0	"	"	21.8-(15)	27.6-(15)	--	Ball diam.
"	0.95-1.09	"	"	21.3	29.6	--	4 mm;load
"	0.87-1.08	"	"	21.6	28.3	--	50-Kg. H
"	0.85-1.14	"	"	22.3	26.6	--	40-50
D	1.06-1.09	0.15-	0.4-				Ball diam.
		0.018	0.18	18.41	32.9	--	10 mm;load
Specified Lead<1.3%, Iron <0.2%, Cadmium <trace The bracketed figures indicate the number of tests, the values opposite them denote the mean value of the tests.							300 Kg, H 55.

Note: The expression, "mkg" wherever used, indicates a unit of energy or of work being the amount expended in raising one kilogram through the height of one meter, in the latitude of Paris. That is one kilogram-meter is equivalent to 7,233 foot-pounds.

Electric Furnaces and the Problem of Sulphur

More High-Sulphur Iron Can Be Used in the Electric Furnace Than Would Be Permissible in the Cupola, with a Given Product in View

By GEORGE K. ELLIOTT

LAST YEAR the author prepared two papers dealing with the then widely unfamiliar subject of treating cast iron in the electric furnace. He described, for the purpose of obtaining more highly superheated and more thoroughly refined iron, a duplex or tandem process that consisted of first melting the iron in the usual way in a cupola furnace and then transferring the molten metal to an electric furnace with basic bottom where it was superheated and refined under a basic carbite slag. Inasmuch as this rigorous refining brought about, among other results, a very marked reduction in sulphur, the subject of low-sulphur cast iron was thereafter projected into considerable of the author's metallurgical life, conversation and correspondence. For it seems that about that same time Dr. Moldenke, ever the alert watchman on the mountain top, was announcing far and wide that iron foundrymen all are face to face with a sulphur problem that, snowball-like as it rolls down along the years, is acquiring a size and direful aspect that is liable to require a serious investigation almost any time, if one does not want to see the whole iron foundry business eventually swamped by the sulphur that is steadily mobilizing itself in the world's scrap-iron pile.

The author confesses to his indifference to this sulphur menace at the time of his papers on account of his recent experiences all having been in a foundry employing only low-sulphur pig iron and coke and no scrap iron of outside origin. However, Dr. Moldenke's well timed remarks anent the subject directed considerable attention to the electric-furnace desulphurizing process described in the two papers mentioned and before long the author found himself a veritable question-box for inquiries about not only the process but also about the effect of sulphur in cast iron and more particularly about iron very low in sulphur such as was described in the papers. Presumptuous and entirely fruitless would it be for me to attempt an answer to the many questions hanging upon this point, but it is my intention to make this brief paper a general statement of the broader facts connected with low-sulphur cast iron and the process by which it can be obtained.

Objections Against Sulphur

The chief count against sulphur in cast iron seems to be that it is a non-metal preempting a place among real metals, a bold pretender, a counterfeit. This it has been able to do by taking on the semi-metallic semblance of the sulphide of a metal; but all the time the foundryman has never lost sight of the fact that sulphur in the form of a sulphide, be it iron sulphide, or manganese sulphide, still is a non-metal and not entitled to an important or vital place in the metal structure.

In plain, unfigurative language, sulphides in cast iron break up the metallic continuity of the mass by freezing last, thereby being enabled to collect in veins along the joints between adjacent crystals of iron. This is true even of so small amounts of sulphur as below 0.05 per cent.; but we are little bothered or concerned by so slight effects. However, when the sulphur content of cast iron gets to be more than 0.05 per cent. it shows a most remarkable tendency to segregate in spots in a way that is liable to increase the harmful effects beyond all numerical proportion. By this it is meant that 0.15 per cent. sulphur will harm cast iron through the increased tendency to segregate, more than three times as much as will 0.05 per cent. sulphur. The writer's estimate would be that the evil would aggregate at least three times three times. It is this sure tendency to segregate, that in my judgment constitutes the greatest menace of high sulphur. Occasionally there is a foundryman learned, experienced and clever enough to make occasional high sulphur iron castings in which the sulphur is uniformly distributed throughout the metal; in such cases there always is widespread wonder at the unexpectedly good quality of the metal so rich in sulphur. Here the word "good" is used advisedly and only relatively. Except when certain well defined qualities such as hardness are required and can be attained by no other way, a low-sulphur will outshine a high-sulphur one when the full inventory of really worthy qualities is taken. By low sulphur in the preceding sentence I mean practical low sulphur of 0.075 per cent., or sulphur scant enough to be incapable of serious segregation.

Sulphur Low in Electric Furnace Heats

However, the basic electric furnace process that was described in the papers mentioned, often produces sulphur so far below 0.05 per cent. that the question is raised as to the advantages accruing from sulphur as low as 0.020 per cent. for example. In this connection I can recall one heat that emerged from the tandem process with the sulphur so far eliminated that it took a gravimetric analysis in the laboratory to discover the 0.009 per cent. that constituted the remnant. To return to the question as to the advantage of so low sulphur, academically it can be answered that the amount of non-metallic intercrystalline film breaking up to some extent the solidarity of the metal mass, is definitely reduced to a minimum that formerly was capable of expression on paper and not in fact. Practically answering the question, it must be admitted freely that in the present state of testing and measuring the qualities of cast iron, we are unable to fix positively any pronounced advantage in gray iron castings with 0.015 or 0.030 per cent sulphur over those with twice those amounts of sulphur. However, there is a sort of speculative satisfaction and assurance in knowing that limits can be and are being achieved in every day practice that certainly are safe beyond all shadow of doubt; that the danger line at least is put a long way off. Possibly a more material advantage in this extremely low sulphur is the fact that the degree of desulphurization can be taken as a very reliable gage of the amount of general refining that has taken place in the metal bath, having in mind particularly deoxidization and degasification.

Another rather indirect but very significant benefit derived from low sulphur in cast iron is a certain independence from high or moderately high manganese. One of the reasons for the presence of this last element in cast iron is the neutralization of the evil effects of sulphur, through preventing the formation of pernicious iron sulphide by forming manganese sulphide in its stead. Frequently iron is overdosed with manganese merely to take care of anticipated high sulphur and not seldom is the sulphur manganese sufficient to increase the hardness and correspondingly decrease the machinability of the castings. If the metal is known to be very low in sulphur, the manganese may be used more sparingly. with a saving not only of manganese but of machine shop finishing costs. The fact has indeed been noticed that electric furnace refined iron with low sulphur, will be harder than cupola iron of the same silicon, combined carbon and manganese content and higher sulphur. This probably is because the manganese, relieved almost entirely of the charge of policing that bad character sulphur, is released to other activities and so goes to work forming double carbides with iron and carbon which has the effect of increasing materially the hardness of the metal. Theoretically one part by weight of sulphur unites with 1.7 parts of manganese to form 2.7 parts of manganese sulphide; that is, sulphur at 0.12 per cent. will unite with 0.20 per cent. manganese to form 0.32 per cent manganese sulphide. Assuming then that we have an iron with 0.80 per cent manganese and 0.12 per cent sulphur, at most only

0.60 per cent manganese is available to form carbide and harden the iron. If, however, the sulphur is reduced to 0.02 per cent, there is needed only 0.034 per cent manganese to take care of it, leaving 0.766 per cent manganese to form carbide. This represents an actual increase in manganese carbide of over one-fourth. Surely, so great an increase is not without some effect upon the hardness. To retain no more than the manganese-carbide-bestowed hardness of the original iron having 0.80 per cent manganese and 0.12 per cent sulphur, the manganese would need to be only about 0.63 per cent in the case where the sulphur is reduced to 0.02 per cent. In this connection the author is called upon to say that differences in hardness such as are illustrated in the preceding example probably would not be measurable or even noticeable in large castings, but that it is distinctly manifest in small ones he can aver from repeated experiences. Also this question of hardness is intermingled with the closely related subjects of the increased attraction of high-manganese irons for carbon, and of the protective influence of high manganese against oxidization in the cupola, both of which have a very considerable bearing upon the subject of hardness.

Sees Wide Use for Scrap

Instead of striving for and accomplishing the low sulphur limits that have just been mentioned it is entirely probable that the more popular practice will be to resort to the use of more scrap or of pig irons running higher in sulphur, for example making mixtures coming from the cupola with 0.120 to 0.150 per cent sulphur or even more, and by duplexing in a basic electric furnace reducing that element to about one-half. In the finer grades of iron foundry work so great a reduction of sulphur as this would show benefits that would be practically demonstrable. It is undeniably possible to improve the general qualities of really high-sulphur cast iron by desulphurization. The more abundant widespread use of scrap is rapidly becoming not only an economic duty for the sake of the conservation of our raw materials, but also in this time of high freight rates, a well-defined need. Here we have a distinctly useful application of the basic electric furnace for rendering fit for service scrap that normally is more or less unfit on account of its accumulation of sulphur.

Desulphurizing Iron and Steel

The chief process used for desulphurizing iron and steel in the electric furnace may be set down in the chemical reaction

$$FeS + CaO + C = Fe + CaS + CO$$
$$MnS + CaO + C = Mn + CaS + CO$$

It is quite probable that the full reaction or sequence of reactions is more complex than here shown although the given reaction does truly represent the essential outline of what takes place. The reaction means that the sulphur is removed from the metal bath as calcium sulphide which is soluble in the slag and not in the iron. A reducing condition is necessary for the success of the reaction, for were the furnace atmosphere oxidizing in nature, the calcium sulphide would quickly be converted into sulphate and as such in turn would react with the iron to form once more iron sulphide which was the original compound of the sulphur in the iron and so would re-enter the bath. From the reaction we see that carbon is required in addition to the lime in the slag; indeed the presence of some calcium carbide (CaC_2) in the slag is a required security that the bath is in the essential deoxidized condition without which the elimination of sulphur is impossible. This is made by throwing powdered coke over the not too thick or viscous slag covering the bath.

In closing the author wishes to emphasize the reducing or deoxidizing nature of the reaction by which desulphurization is accomplished in this electric furnace process. By it, getting rid of sulphur is made a double blessing; and who knows what and how many of the virtues of basic electric furnace iron are in reality due not only to low sulphur but also, and perhaps to a much greater degree, to the chemically deoxidizing influences by which it has been refined?

REFRACTORY CEMENTS

By W. S. Quigley

The title I have chosen for this brief paper is purposely selected to bring out a point with reference to high temperature cements on which there is some misapprehension. A refractory cement is not itself just a refractory but bears its title from the fact that it is used as a binder for refractories. There is probably not a commodity used to-day by manufacturers in general that is as little understood or as much overrated as are high temperature cements.

In foundry circles there has been a great deal of educational work during the past two or three years on the use of refractory cements, and while their successful application is well understood by many foundrymen there remains much information yet to be uncovered on the whole subject of their many and varied uses. This use sprung up rapidly during the war owing to the necessity for using material owing to refractories which, by increasing the life of linings, would prevent shutdowns and by the use of which repairs to furnaces could be quickly made.

Four Classes of Bonding Materials

Bonding materials may be divided into four classes.

First we have fire clay, the primary function of which is to compensate for the inequalities of the bricks or shapes as a pliable refractory filler, and with which unduly thick joints generally are made. It has no binding strength of itself unless subjected to a vitrifying temperature. For the material itself there is no definite recognized standard or specification so that the user is dealing with a varying commodity. Furthermore, since heat is required for vitrification in order to obtain a bond, it is obvious that only a surface bond is obtained, as the required heat for vitrification will not penetrate the entire thickness of the wall. The result obtained may be likened to a vitrified shell with a weak structural backing. Furthermore, the shrinking of the fire clay due to its own moisture and the combined water used in mixing it, causes a separation between the bricks or shapes in walls or arches which frequently results in bulging walls or collapse of the whole structure.

Secondly we have coarse grades of mixed materials or so-called cements which also have no binding quality, depending upon heat or vitrification for a bond. Materials of this class must be made to bind or fuse at approximately the same temperature at which the furnaces are run, or no bond is effected. In other words, a cement which is good for a low temperature annealing furnace is not good for a high temperature forging furnace, or vice versa. Such mixtures are subject to the same surface bonding result as fire clay.

Thirdly, some cements in order to hold the component parts together depend upon a fibrous structure which shrinks and eventually loses its binding value as soon as subjected to any considerable degree of heat. Such cements must lose their effectiveness as the temperature increases.

An Ideal Cement

Finally, to be universal in its application, a cement should air set and not depend upon heat for creating the bond in order to form a union throughout the structure. It must be passed through a very fine mesh sieve so as to contain coarse particles which would tend to create voids between the brick which it is used to bind. It should not shrink when subjected to heat. It should be a material which can be used as a binder with crushed fire brick, old crucibles, fire sand or fire clay, ganisters, and for making rammed-in linings, and doing repair work, hot or cold. And furthermore, its composition should be such that it can be used in neat form for making small hot patches and repairs.

The principal essential of a refractory cement is that it should have at various temperatures, the same co-efficient of expansion, as nearly as possible, as the materials with which it is used for bonding. Refractories themselves differ in expansion co-efficient, as in the case of fire-clay brick and silica brick, where the former has 0.075-inch and the latter 0.175-inch per foot at 2,200 degrees Fahr. Yet a cement with a co-efficient which lies between these two could be advantageously used with both refractories.

The difference in the cost between fire clay and high temperature cements must be justified by the difference in the results obtained.

The World's Earliest Examples of Metal Work

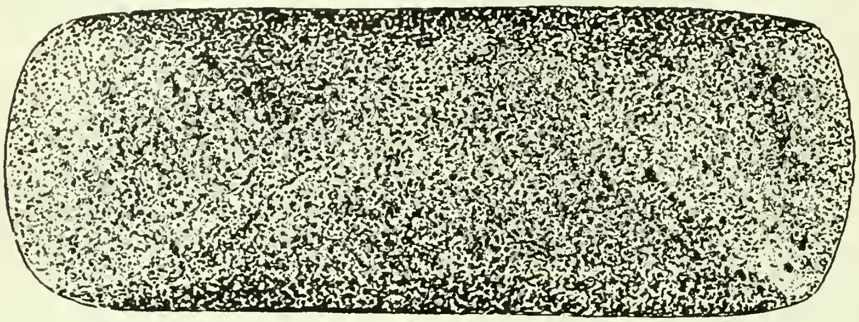
Copper The First Metal Known—Early Tools Of This Metal Followed The Same Design As Their Stone Predecessors—Subsequent Improvements In Designs and Metals

WHEN WE read the statistics of the world's annual output of pig iron, of the enormous nickel deposits at Sudbury, of Lake Superior copper, Australian zinc, Cornwall and Banca tin, and the numerous other metals which contribute to keep the various different foundries in operation or when we consider the rare and precious metals such as gold, silver, platinum, etc., it is hard to realize that there was a time when men like ourselves worked along on this old planet and enjoyed their lives, probably as well as we do now without even knowing that such a thing as metal was in existence, and it is even harder to figure out how they did it. Such, however was the case, and it is quite possible even now to look with our own eyes upon the instruments with which the former inhabitants of the earth performed their labors. Compared with other discoverers such as fosils and bones, the stone age does not date very far back into antiquity. It was, of course, quite a while ago. It was before the time of Christ, before the birth of Moses; before the time when the patriarch Abraham sat in the shade of the pyramids of Egypt, in fact it was before Abraham was thought of; before Tubal Cain the great Vulcan of old, beat his swords into plow shares. It was even before man had decided to write down his doings for the benefit of those who would live after him. But his doings were written in a language of which he little thought, and of which the archaeologist of to-day is an apt scholar. The archaeologist can read this language and lay it before his audience in so clear and comprehensive a manner as to preclude any thought of doubt.

It is not necessary to go into the details of ancient history but those who have made it a study have ways of arriving at approximate dates, which is to say they know the period in which things transpired.

In digging up the bones of pre-historic animals, they are governed by the formation of the earth in which the bones are found, and their antiquity dates back into the millions of years, but a matter such as the beginning of the metal industry is so comparatively modern that it could almost be considered as being in the present age.

Almost every house which has a boy as one of its occupants can be depended upon to have an accumulation of stone arrow heads and axes which he has picked up in the fields or along the banks of some stream which he in his youthful innocence attributes to the handiwork of the red Indians who roamed the Canadian forest until they were driven back by the invading white man. But he is undoubtedly astray in his calculations, as the stone objects which he is harboring, and which he is wise enough to know are to some extent, "curious" are real antiquities and are of far more importance than he realizes. Between seven and eight thousand years ago stone was the material from which tools and weapons as well as almost everything else was made.



Latest pattern of stone axe and earliest of copper.

The Stone Age

This was known as the stone age and the people who dwelt upon this earth at that time were smart and intelligent, and had a civilization, which while not the same as ours was not necessarily inferior. Their mechanics were evidently of a very high order, judging from the work which they did in stone, with nothing but stone tools to work with. Wood was, of course, common and was, of a certainty used as fuel, but stone axes were used to chop down the trees. The men shaved in those days and had stone razors. In fact they accomplished whatever feats had to be accomplished, but they did them with stone tools, and not knowing any better method they would probably be as contented as the average man of to-day.

But man is never satisfied; he is not satisfied to-day and is looking for improved methods. So it was in the stone age. He knew that to take a stone hammer in one hand and a chisel made of the same material in the other and proceed to laboriously dress down another stone into the form of an axe represented a lot of work. This may not have been the method employed, but whatever method he was forced to adopt, it was certainly open for improvement, so the man of the stone age kept his eye open for something better until he discovered that copper could be worked into shape and kept in working condition more easily and answer the purpose just as well if not better. That stone was also used for weapons, not only for protection against wild beasts and in warfare but for slaying the beasts which constituted the food supply is an undisputed fact. That copper and bronze supplanted stone in all its calling is also accepted, but since the evolution which took place affected them all in like manner we will confine our story to one article, the axe.

In the Royal Ontario Museum, Toronto may be seen examples of stone axes in a very primitive state, with others gradually improving in design until those similar to the fairly graceful one here shown might be considered amongst the most modern. Next to this may be seen copper ones which show very little difference in design.

In the original copper axes it was evidently considered that enough had been accomplished when they had escaped the labor of cutting the stone ones, and little thought was given to improved design. No place was allowed for the handle, other than to fit the axe into the handle. This continued for a time, when a hardener was introduced, to improve the cutting and wearing qualities; a crude attempt was made at a handle fixture. Later ones show more improved handle arrangements, until the present design was arrived at.

Flint Arrow Head of great age.

In our next paper we will show the original copper axe with the various steps towards our modern axe so that the metal worker of to-day may see where his trade began and what a slow and laborious task it must have been to think up improvements, with no precedent to follow.

Some of The Economic Minerals of Canada

Some Figures of Production Taken from the "Preliminary Report on the Mineral Production of Canada During the Year 1920"

By WYATT MALCOLM

Tungsten minerals occur at a number of points in Canada but very little has yet been mined. A small quantity of schelite has been recovered from veins a few inches thick lying in the bedding planes of slates of the gold-bearing series of Nova Scotia near Moose River mines. Development work has also been conducted on Burnthill brook, New Brunswick, on a deposit of wolframite, found in argillites near the contact of a granite intrusion and small shipments have been made. A small amount of shelite has been saved from the sluice boxes of the placer gold mines of Dublin gulch, Yukon Territory. Several other occurrences are known, among the most important of which is that of Hardscrabble creek, Cariboo district, B.C.

Platinum

Platinum, the precious metal so essential in certain chemical industries and laboratory work, and so much prized by jewellers as settings for precious stones, is produced in small quantities in Canada. A small amount is recovered from gravels in Tulameen district, British Columbia. It occurs also in the nickel copper ores of Sudbury and is recovered in the refining processes. Traces have been discovered in placers in other parts of the country, and in sulphide ores, but production is limited to the two sources mentioned above.

Asbestos

Canada leads the world in the production of asbestos. This is a mineral that is readily separated into fine, strong, cottony fibres that can be spun and woven. It is used in the manufacture of fireproof fabrics, fireproof building material, brake lining, and heat and electric insulation.

The mineral occurs in veins in serpentinized peridotite. The veins are usually 2½ inches or less in width, the greater number being less than ½ inch. The fibres usually run at right angles to the vein wall, and very commonly the vein is divided longitudinally by a film of iron oxide. The length of the fibre is thus limited by the width of the vein, or the parts into which the vein is divided by the film of iron ore.

The best grades, known as crude, are cobbed by hand from the rock, but in the recovery of the asbestos of the smaller veins the rock is crushed and the fibre removed mechanically.

Although a small quantity of asbestos has been produced in Ontario, nearly the whole production comes from the province of Quebec. The most important deposits are at Thetford and Black Lake in the Eastern Townships. The asbestos-bearing rock is recovered partly by open-pit quarrying and partly by mining.

Graphite

Graphite has been mined intermittently in eastern Ontario and southwestern Quebec for over fifty years, and in recent years a small quantity has been obtained from Baffin Island. The mineral occurs as disseminations of varying degrees of richness through rock, in veins, and in aggregations of irregular shape in rocks of Precambrian age.

Gypsum

Gypsum occurs in abundance in the provinces of Nova Scotia and New Brunswick in sedimentary rocks of the Carboniferous system. Many of the deposits lie near the sea and have excellent shipping facilities. The mineral is obtained by quarrying, the overburden consisting of varying thicknesses of loose drift.

Lenticular beds of gypsum occur in the flat-lying Silurian sediments along Grand river in southern Ontario. These are not deep and are reached by slightly inclined tunnels driven in the sides of the valley. Beds of gypsum outcrop in Moose River basin, northern Ontario.

Large deposits of this mineral are found in rocks of Silurian age, in Manitoba, northwest of Lake St. Martin. It is recovered by quarrying.

Deposits of gypsum occur at a number of points in British Columbia, and an extensive deposit is exposed in cliffs on the lower Peace River, in northern Alberta.

Gypsum is the raw material from which plaster-of-Paris is made, and as such is of interest to foundrymen. If put in its natural form into a kettle it will boil in its own moisture until dry, after which it must be kept dry, as once moistened it will set and be of no further use. It is also used in the manufacture of Alabastine and other wall coatings.

Magnesite

Magnesite is one of the minerals the production of which was given a great impetus by the war. The cutting off of the supply from Austria, and the nearness of the Canadian deposits to the markets of eastern North America where the material is used as a refractory for furnace linings, greatly favored the industry.

The deposits worked lie in Argenteuil county, west of Montreal, Que. The mineral occurs in rocks of Precambrian age. Deposits of hydromagnesite are found in Central British Columbia, and in the Atlan district, but little has been done towards their exploitation.

Talc

Talc is found in the provinces of Ontario, Quebec, and British Columbia, and is mined in small quantities in British Columbia. Nearly the whole production of Canada, however, is from Hastings county, Ontario, where it occurs in sediments of Precambrian age. Most of this is ground in mills at Madoc and Eldorado. The total shipment of crude and ground talc by mine operators in 1913 amounted to 18,642 tons, and the shipments of ground talc for the same year amounted to 15,927 tons of different grades having an average value of $14.75 per ton.

Structural Materials

The value of the structural materials, including cement, clay products, lime, sand, gravel, and stone produced in 1920, amounted to over $38,000,000. The war had a detrimental effect upon this industry in Canada as in other belligerent countries, and the production fell from nearly $31,000,000 in 1913 to about $17,500,000 in 1916.

Good grades of granite, marble, limestone, and sandstone are quarried, and in places not very remote from the more populous parts of the country. Clays and shales suitable for the manufacture of building brick are widespread, and material of superior grade, some suitable for fire-brick, is found at a number of points.

Limestone, low in magnesia, and adaptable to the manufacture of Portland cement, is common, more particularly in the southern part of the provinces of Ontario and Quebec, the most densely settled parts of Canada. Manitoba, Alberta and British Columbia have producing cement mills, but by far the greater part of Canada's production comes from Ontario and Quebec. The total amount sold from Canadian mills in 1920 was 6,651,980 barrels valued at $14,798,070.

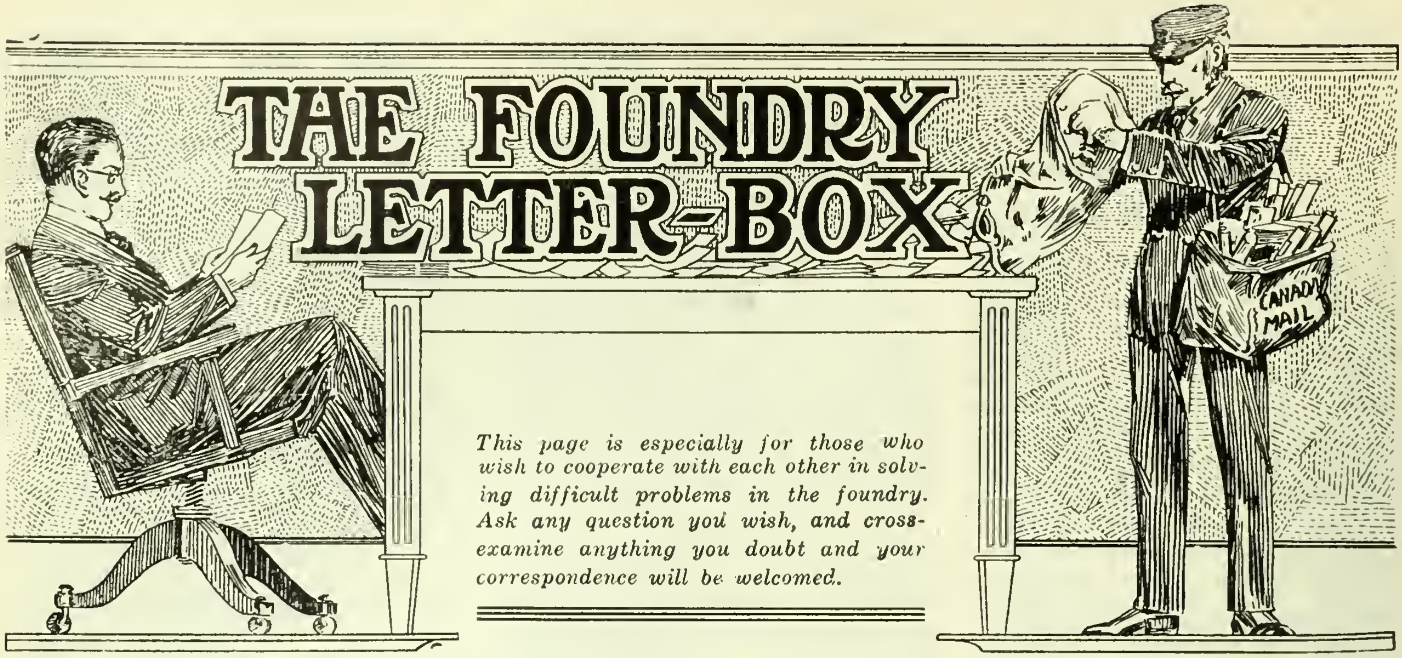
PORTABLE TRAIN

(Continued from page 25)

The overhead clearance when the jib is lowered into a horizontal position is such that it will pass under a 7 foot 6 inch doorway. The weight is so disposed that with the jib fully loaded, and in any position, the maximum weight on any one wheel never exceeds one ton. Provision is made to enable the apparatus to become a tractor and it will draw a load of 3 tons at the rate of three miles an hour. The crane is equipped with a storage battery of sufficient capacity for an average day's work. This battery is of 258 ampere hours capacity.

The runabout crane truck is manufactured by Messrs. Ransomes, Sims & Jeffries Limited, Orwell Works, Ipswich, England, and the crane mechanism is the production of Messrs. Ransomes & Rapier Limited, also of Ipswich, England.

The atmosphere is the transparent and elastic body of mixed gases and vapors which envelopes our globe, and which derives its name from Greek words, signifying sphere of vapor. It is estimated to extend about fifty miles above the earth.



This page is especially for those who wish to cooperate with each other in solving difficult problems in the foundry. Ask any question you wish, and cross-examine anything you doubt and your correspondence will be welcomed.

MELTING ONE TO TEN

Mr. G. O. Vair, foundry superintendent at the Forewell Foundry, Kitchener, Ont., has handed us a clipping which he dug out of his abundant store of such, and in which a Canadian foundry foreman of by-gone days had taken exception to a previous article in the "Scientific American," which had evidently deprecated the idea of melting ten pounds of iron with one pound of coke. The letter is interesting, inasmuch as it shows that the same things occupied the minds of the foundrymen then as now. Some foundrymen have always been able to prove that they could do things which others were able to prove were impossible. Following is the letter:

Iron Melting

To the Editor of the Scientific American:

I have carefully read the article on iron melting in your issue of October 20, 1888, and do not agree with it as a whole. I believe if cupola blast and all things connected with melting iron are right, there will be but little trouble in melting 10 to 1 or even better than that. A man from Marshall, Texas, offers $250 to any one who will melt 9 tons at the rate of 14 to 1 in his 38 in, cupola. In my opinion a cupola that size is far too small to melt such an amount of iron, and I think there is no more chance to practise economy with a cupola that is too small than with one too large. My experience is rather limited, and I will be careful not to say too much.

I am in the habit of melting from 3 to 5 tons of iron per day, and see no reason why I could not melt 20 tons at the same rate, that is, 10 to 1.

When I first took charge here, I found I could not melt better than 6½ to 1, but have made several changes about the cupola, and can now melt every day we run more than 10 to 1.

The iron is plenty hot enough for our lightest castings, and as long as cupola runs a stream, the iron is fit to use. Below you find my average for eight heats. I use an old style cupola, 38 in., with three tuyeres:

	Iron	Fuel
August 22, 1888....	7,200 lb.	675 lb.
August 23, 1888	7,600 lb.	700 lb.
August 24, 1888	7,600 lb.	700 lb.
August 25, 1888	7,600 lb.	700 lb.
August 27, 1888	6,900 lb.	625 lb.
August 28, 1888	6,500 lb.	600 lb.
August 29, 1888	6,200 lb.	575 lb.
August 31, 1888	6,100 lb.	575 lb.

I would be pleased to melt before witnesses if any one doubts the above. I weigh all fuel and iron used, and know just what I am doing.

JOHN H. CROUSE,

Foreman, J. O. Wisner, Son & Co., foundry.

Brantford, Can., November, 1888.

Mr. Vair, who has had many years of experience as a foundry foreman, and who, like most foundrymen, has travelled a lot, concludes his letter by saying, "I don't run across many, if any, foundries which get the 1 to 10 ratio, do you?"

This being in the form of a question, I am constrained to answer it.

My experience has been similar to that of Mr. Vair—I have seldom seen it done, although I am not saying that it can not be done. If everything is favorable, a thirty-eight inch cupola would no doubt do what Mr. Crouse says, but the risk is great. My experience has been that iron melted in that manner, while making good enough looking castings, did not make sound castings. Cylinders, air chambers, etc., which looked perfect would leak when put to the test.

Personally, while advocating economy, I can not see the economy in stinting the fuel, when a dollar saved might mean hundreds of dollars lost. All things considered, I am forced to the same conclusion as that of Dr. Edward Kirk, author of "Cupola Furnace" and one of the most outstanding authorities on cupola practice in the world. Dr. Kirk says that in his long career, in which he has visited more foundries than any other living man, he has found that where iron was melted in these proportions, there were generally a few car loads of coke unaccounted for at stock taking time and which were charged to the profit and loss account in order to balance the books, and the boss would go on from year to year kidding himself with the belief that he was doing some economical melting. —Editor.

WANTS INFORMATION ON CHILLS

Editor Canadian Foundryman:—Could you inform me whether or not it would be injurious to use a casting when it had been previously chilled, as a chiller for another casting? This is a heavy piece weighing in the neighborhood of one thousand pounds. You will oblige me by giving me this information at an early date.

Answer: I understand that you are not going to melt this chilled piece which you have and pour it into another one, but are going to ram it into the mold and pour the other one onto it. I am not sure whether the piece you now have or the one you are making is the thousand pound one. However, the secret of hardening cast iron by chilling is to pour the melted iron against a piece which is not melted. The heat contained in the melted iron is absorbed by the cold iron of which the chiller is composed, thereby causing the melted iron to set before the carbon has time to free itself. If you have a thousand pound piece which you are using for a chiller it would absorb an enormous amount of heat in a short time and would do a good job of chilling, but the fact that the chiller itself had been chilled at the time it was poured would have no effect either good or bad on the new casting. If you should be pouring a thousand pound chunk onto a comparatively thin piece of chilled iron, the chiller will continue to absorb heat from the heavy chunk until it melts and becomes the same temperature as the melted chunk, after which they will both slowly cool together. The heavy piece will not be perceptibly hardened and the chiller which had formerly been a chill-hardened piece will be perfectly soft. I think I am correct in assuming that you contemplate pouring a heavy piece onto a heavy chiller and fear bad results as a consequence of the chiller being a chilled casting, but your fears are groundless, as the contents of the chiller are in no way reflected into the melted metal. It is the carbon in the melted iron which does the hardening, and for this reason be careful to use iron which is low in silicon, as this will automatically be high in carbon.

WANTS FORMULA FOR STATUARY BRONZE

Editor, Canadian Foundryman:—Can you give me a good mixture for statuary bronze? I have a chance to make a bronze tablet and want to be sure that I have the proper material from which to make it, as the customer is somewhat particular to have it just right:—

Answer:—Statuary bronze is not particularly different from any other bronze. Its chief requirement is to run freely and to have a good color. The, United States, standard bronze which consists of 88 copper, 10 tin and 2 zinc is quite frequently specified in the order, and this makes a good statue or tablet, but where no formula is specified it is quite common practice to use 90 copper, 5 tin, 4 zinc, and 1 lead which gives equally as good a color and is somewhat less expensive. Tin gives bronze a nice shade and it assists in having the castings run well, but it is expensive and is usually reduced when possible. One thing to be considered in doing statuary work is to be accurate in proportioning the alloys so that if by any means it is found necessary to do any repair work, or if the statue is to be made in parts, the completed statue will all be of the same shade. While the exact shade is not so particular it is of prime importance that the same shade be carried right through. Another thing which must be watched carefully is the melting. It is possible to get the metal too hot, but this is seldom the case. It is a more common occurrence to have it not hot enough. If the various component parts are to be thoroughly mixed together so as to give a uniform shade throughout, the metal must be melted hot enough to allow of mixing and at the same time to retain sufficient fluidity to flow freely into so thin a casting.

DOES NOT FAVOR CORE OIL

Editor Foundryman:—I notice in your last issue an inquiry for a suitable core sand mixture for bibb cocks, etc., and your answer in which you recommend oil. While I am prepared to admit that linseed oil and other oils with a linseed base have a lot of good features and may possibly be the best for iron foundry work I must say that I cannot agree with you that it is the safest for light brass castings. In fact I would not use it and never do. I have made thousands of bibb cocks and am still making them in brass and aluminum, and have none of them blow or cut. Right here in Galt we have a sand which is not loamy enough for molding sand, yet it is not pure sharp sand. If analyzed it will be found to contain a high percentage of magnesium and of lime, yet with all its apparently undesirable qualities this is the sand we are using. We mix it dry with Dextrine in the proportion of one part of Dextrine to sixty of sand. When thoroughly mixed we temper it with cold water. We make heavy brass castings as well as light and use this kind of core sand on them all with the best of results. Trusting that this may be some help in solving a difficult problem.

Thomas Langley,
Langley & Austin Brass Works,
Galt, Ont.

RUSTLESS IRON

In our last issue we published a very interesting article on rustless iron, extracted from the Foundry Trade Journal, in which it was stated that so far it had been only adapted to rolling mills and forge shops, but not to be used for making castings. This metal it will be recalled contained from ten to twelve per cent. of chromium and the balance was as near as possible to pure iron with the carbon and silicon eliminated. Now comes a reply from W. J. Turner, of Sanstain, Limited, Liverpool, which reads as follows: "We can say from practical experience obtained by ourselves and friends interested in the matter, that there is apparently no good reason why satisfactory castings should not be regularly produced in stainless iron or stainless steel, with due observance to the practical problems involved.

"We have made, under primitive conditions, both medium size and small castings which have turned out excellently, and consider that the near future will show great developments in this direction."

From this it would look as though rust-proof castings are to be part of the foundryman's business in the near future.—Ed.

FRANKLIN D. JACOBS RECOVERS FROM SERIOUS ILLNESS

The many friends of Franklin D. Jacobs, so well known throughout the country among the hardware trade, foundry supply houses, and kindred lines, will be glad to know that he has so far recovered from his illness of the past six months that he is now removing from Milwaukee, Wisconsin, to Cleveland where he is resuming his active work as special sales representative with The Osborn Manufacturing Company.

During Mr. Jacobs' many years with The Osborn Manufacturing Company, he has become well known in the hardware and general supply trade, having at various times covered extensive territories in the Middle West, including Kansas City, Omaha, Lincoln; also in the South, working from Louisville to Birmingham, Atlanta, Richmond and Norfolk; and later spending a number of

FRANKLIN D. JACOBS.

years in Philadelphia, New York and New England.

Acting as special sales representative, Mr. Jacobs during the next year will cover a wide territory, and is enthusiastic at having so far regained health and strength that he can look forward to the pleasure of meeting his many old friends and acquaintances.

COAL VERSUS LIGNITE

In the study of the ignition of coal dust clouds in open air, being conducted at the Experimental Mine of the Bureau of Mines, Bruceton, Pa., tests were recently had with pulverized Colorado lignite. In some of these tests flame extended 45 feet into clouds that were 50 feet long, the lignite dust cloud making a larger flame than Pittsburgh coal dust. An attempt will be made to get a great length of flame with an increased length of dust cloud.

We have received bulletins Nos. 220 and 221 from the Uehling Instrument Co., Paterson, N. J. The first deals with the magnitude of the losses due to the chimney in a power plant, and contains diagrams reproduced from a paper issued by the U. S. Department of Mines. The bulletin No. 221 deals with the relation between CO_2 and the money wasted up the chimney and contains tables of these losses with different kinds of fuels. A set of curves showing the saving by increasing the percentage of CO_2 in the flue gases is also given.

PLATING AND POLISHING DEPARTMENT

PLATING AND POLISHING

Question.—We have several thousand sulky wheel hub cases to nickel-plate. In buffing these cases we find a large percentage of them spoiled by the nickel peeling on the run which holds the spokes. In some cases, the nickel cracks off in flakes and in other cases the nickel curls of in strips. We have used extra care in cleaning, but the trouble continues. Please advise us as to method which will correct the difficulty. I may add, we nickel-plate directly on the steel.

Answer.—As you have neglected to mention particulars respecting actual working conditions in your plant, we are compelled to reply to your question in a rather general manner, that is, we can only surmise that certain conditions exist and advise you accordingly There are several conditions which would be favorable to peeling on the hub case run. Too high voltage, solution temperature too low, poor conductivity of solution, alkaline solution, low metal strength, unclean rim. These are some of the more probable causes. Of these we are inclined to believe poor conductivity and alkalinity, or poor conductivity and low temperature are the causes which you should look to first. To increase the conductivity, add to each gallon of the bath, 2 oz. of magnesium sulphate and 2 to 3 oz. of nickel sulphate. Dissolve these chemicals in a portion of the solution which may be placed in a clean whiskey or wine barrel or a stoneware crock. Then add to the solution in plating tank. Stir the whole thoroughly and allow to settle before using. Use a long stem testing thermometer to obtain correct temperature of solution near bottom of the tank. A nickel solution operated at a temperature below 60 degrees Fah. is liable to be very "tricky." If you cannot maintain the solution at higher temperature during nights and weekends, you may improve your working conditions by removing about one-fourth the volume of the bath to clean barrel and heat the solution by injecting steam, then replace in plating tank by pouring through a fine mesh sieve or cheese cloth strainer to avoid disturbing slime at bottom of the tank. Increase the conductivity of the solution and the proper ampere current density can be obtained without increasing the voltage. In fact, you will probably be able to use a higher current density at a lower voltage than you now employ, thereby reducing the tendency to brittle deposits even though the nickel solution be a little unbalanced respecting acidity. Inspect the anode surface, see that each anode has good contact with positive tank rod, and that each anode is disintegrating properly. If you find that the nickel solution requires frequent additions of nickel salts, (Beaume), you may conclude that the anodes are not feeding the solution properly, possibly because you have an insufficient number of anodes in the solution, or they are of an inferior quality. Now, remember the nickel content of the anode may be high, or up to your specifications, and as a nickel casting it may be absolutely perfect but, as a anode to be used in an electrolytic process such as electro-nickel plating, it may prove to be practically useless. Why? Because it will not disintegrate properly in any nickel solution. The anode may break up and wear away, but the structure is of such nature as to make it practically impossible to dissolve the anode. I therefore gradually falls to the bottom of the tank and forms small moulds of metal beneath each anode, and is finally shoveled out as waste, yet, this material often contains as high as 56 per cent. nickel in the form of shreds. After giving the above details due considerations it will be well to again take notice of your cleaning operations, simplify them as much as possible, but, be sure the surface of the work is chemically clean when placed in the nickel solution. A dilute hydrofluoric acid dip is a splendid final safeguard for steel, keep the surface of the final acid dip free from slightest film of scum.

* * *

Question.—My helper added fifteen pounds of nickel carbonate to a 150-gallon cyanide copper solution, mistaking the nickel carbonate for copper carbonate. The deposit obtained after the addition was of a greyish tone and nickel deposits which were obtained on the work, subsequent to coppering in above solution, withstood the buffing operation, but, proved non-adherent shortly after being subjected to ordinary wear by purchasers of the completed product. In each case, the nickel separated from the copper and the exposed copper was a dull dirty grey color. We have ceased to use the solution and will await your advise respecting a possible method of saving the solution by some process which will remove the nickel or render it harmless to copper castings. The solution is used hot with a current of about 5 volts.

Answer.—Do not add anything to the copper solution, simply heat it as usual and suspend a bunch of small wires in the solution, turn on all the current possible and allow to plate in this manner for at least three or four days. If the anodes coat over with dark oxide do not interfere with them as it is not necessary to get a copper deposit. You require a condition which will tend to permit the removal of the nickel from the solution. In doing this as here suggested you will deplete the copper content of the solution to some extent but not seriously. After three or four days' operation as above described, add enough sodium cyanide to clean the anodes and proceed to plate the bundle of wires as before. Note carefully the shade of deposit obtained with varying current densities at this time and if the clean pink tone characteristic of pure copper is not obtained, continue the electrolyzing treatment for a day or so longer and test again as before. The nickel will eventually be removed sufficiently to permit the regular use of the solution for general purposes as originally intended. If the copper solution contained caustics it would alter the results. The above remedy is intended for copper solutions prepared and maintained without introduction of caustics. If your product is of a nature which encounters exceptionally frictional wear in ordinary use, we would advise prolonged electrolytic treatment before using same for plating purposes. Build up the metal strength with copper cyanide and there will be no excuse for any one mistaking nickel carbonate for the proper copper salt when replenishing the solution.

* * *

Question.—We intend enlarging our plating department and wish to have your correspondent's opinion as to the relative merits of concrete, asphalturn, wooden blocks, or a combination of any of these materials for plating room floor. Our plating plant will be located on the ground floor, and the proper flooring for this place seems to be a matter we cannot settle agreeably among ourselves. An early reply will be appreciated.

Answer.—Personally, we have no fault to find with a properly laid concrete floor. The question of mixture, depth of foundation, the surfacing, are probably the most important points aside from the drainage. Irrespective of material used, it will be necessary that you attend closely to the fall obtained, so that when dry you may have sufficient drainage to clear the entire floor of water. Many otherwise good floors have been ruined by low spots here and there over the surface, or by too little fall per foot. A good cement base covered with about 4 or 5 ply tar paper and finished with asphaltum will give excellent service if protected from punctures, which may be caused by prongs on ladder ends, or other sharp instruments. We have seen concrete (Portland cement and sand floors,) which became worthless in less than two years owing to unreasonable carelessness in the use of acids and strong alkalies. The average cleaning compound in use to-day in solutions employed for the preparation of metal goods for plating is not injurious to good asphalt floors. Strong acids or mixtures of strong acids, will gradually eat away the best asphalt or wooden floor it is possible to lay. If a well-laid foundation is laid and a strong mixture of cement and sand used to build a solid floor, not a mere shell, and the whole given a top dressing of extra fine mixture, we do not believe that imperfections would develop during a number of years of constant use. A plating room floor should be well washed every day after dipping operations are finished; turn the hose on every nook and corner, wash the sides of tanks off and avoid the accumulation of metallic salts, pools of acidulated water or other matter. A plating room .5 feet wide should have a floor with not less than a 4-inch fall from either side to the centre. The slope should be uniform. This is a feature which depends almost entirely upon the foundation. Creosoted wooden blocks, parafine-coated blocks, and "sawdust brick" have been used in some large plating plants in the U. S. with some degree of success. Vitrified paving brick laid in asphalt has been used; it is more expensive than the concrete and asphalt floor, and we are not aware of any points of actual merit which are possessed by the former type only. If you build wooden sections of narrow strips on 2 in. x 4 in. scantling and cover the floor in the vicinity of the tanks and wash the wooden covering and floor well and regularly every day, we believe you will receive general satisfaction from a good concrete floor. Avoid imbedding steam pipes in either concrete or asphalt floors. Water pipes are not injurious, but it is not good practice to place water pipe where it is liable to require removal of the floor in case of defect in water pipe. We would advise letting the contract to a first-class workman in any case, and then give work your personal attention to insure satisfaction regarding points we have mentioned. Do not use floor too quickly after it is completed.

* * *

Question.—Can you inform me of a material which may be used in a hot cleaning solution to remove vaseline from steel as received from foreign manufacturers. I am using soda ash solution and subsequently an electric cleaning solution made from a mild washing compound, which we buy prepared. An additional operation with brush and pumice is necessary to properly clean the steel. This means too much labor and slow production.

Answer.—If the steel is in the form of a manufactured article and can be tumbled, we would suggest tumbling in clean sawdust for 30 minutes. If this is not possible, try cleaning with sawdust by hand; a boy or girl could do the work. If, however, these methods are of no value, prepare a solution of soda ash and water, 8 oz. soda per gallon of water; add to this 4 oz. of good soft soap; use at 210 deg. Fahr.; rinse in hot water; then run through the electric cleaning solution, as you have been doing. A copper strike would assist you and effect a cleaner surface condition on the steel. Keep scum removed from surface of all solutions used by frequent skimming.

* * *

Question.—I have a brass solution which has gradually gone wrong. The deposit is more like bronze than brass. During latter part of each day the color is quite grey. I have added copper and zinc and cyanide until I fear something worse will happen. Can you tell me how to correct the action of the solution?

Answer.—If you have added the various salts in sufficient quantities to raise the density of the solution above 10 degrees Be., remove enough of the solution to enable you to dilute the portion left in the tank to about 8 or 10 degree Be., Electrolyze, test the color obtained on the cathode and if still too grey add copper cyanide or copper carbonate in small quantities until the required color is obtained. In replenishing brass plating solutions you may generally act exactly the opposite to what would ordinarily be considered correct when replenishing solutions of other composition. In other words, add copper when zinc appears to be required. Brass baths require very little zinc after first prepared in correct proportions. If you will use copper anodes and zinc anodes, 2 of copper to 1 of zinc, and be careful in the addition of zinc salts, keeping the cyanide content as low as possible, we believe you will have very little trouble with your color. Try the method in a small tank or crock for a few weeks and study the nature of the changes as compared with changes taking place in your old solution, then act accordingly. We have never been able to operate a bath such as yours as economically as one prepared as we have stated. Aside from economy this method will eliminate the frequent annoyances which are common with the old style of bath, the color of deposits is more easily controlled and heavy castings rapidly obtained.

* * *

Question.—We nickel-plate small wire pins, one-eighth inch diameter by three inch long. These pins have a head on one end and are suspended in perforated pieces of brass while being plated. Recently the lower ends of the pins have acquired a tree-like formation of nickel during the one-hour treatment in nickel tank and the removal of this excess metal often results in large quantities of scrap pins. The condition is becoming more serious every day. Kindly advise us of cause and remedy at earliest convenient date.

Answer.—Filter the nickel solution, clean the anodes, replace solution and anodes in tank and test the solution for acidity and metal. You will probably find it deficient in both. Add nickel sulphate to restore normal metal strength and if the solution is still too near neutral point add sulphuric acid until litmus blue is quie perceptibly changed, add acid occasionally to maintain good working condition and if further difficulty is experienced of same nature, increase the conductivity of the solution by adding either magnesium sulphate or sodium chloride, say, two ounces per gallon. We do not believe you will experience any difficulty after cleaning and replenishing the bath.

* * *

Question.—We have contracted to manufacture and nickel-plate a steel cup-shaped article about one inch diameter by one and one quarter inch long, the cup is turned from solid steel and is hardened before going to finishing operation. We have found that polishing costs too much. How shall we proceed to obtain a reasonably good finish on the cup by tumbling?

Answer.—In any event it will pay you to attend to all cutting tools used in the process of manufacture so that a smooth surface is obtained by the screw machine operation. This would assist in reducing cost of polishing and also facilitate rapid finishing if tumbling is adopted. To tumble the cups we would advise use of sand and water for first or roughing operation, add enough soda ash to water to act as lubricant and retard rusting. Rough for about 12 hours, of if cups are scored possibly 24 hours will be necessary. Remove from tumbler, wash free of sand and place in a wooden or woodlined iron tumbler with alkaline water, treat at same speed for at least six hours, remove, rinse, place on racks or plate in mechanical plating machine rotated at very slow speed; the deposit obtained in the machine may be buffed if the duration of plating treatment is not hastened.

The pressure of the atmosphere at the earth's surface is fifteen pounds (14.7 to be exact) to every square inch of surface. That is to say, that the column of air, extending fifty miles from the surface of the earth and bearing down on a square inch of earth, presses upon that square inch with a weight equal to approximately fifteen pounds.

There is a slight distinguishing difference between the crystals of hoar frost and those of snow, which may be accounted for by the various degrees of temperature in the atmospheric region where snow is formed, or by the different effects of the magnetism of the earth and the electricity of the air.

If troubled from cinder in the eye, roll soft paper up like a lamplighter, and wet the tip. This can be rubbed against the ball of the eye without causing pain, but by carefully touching the wet end to the cinder it will adhere to it. A medicine dropper can be used to suck the cinder from the eye.

F. H. BELL, Editor

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Industrial Conditions

IT IS A LITTLE early yet to predict what we have ahead of us for the coming year, but everything would seem to encourage the belief that things are shaping up for a good season. Very few foundries are running to capacity and as a matter of fact many of those which are running at all are simply endeavoring to keep their married employees working sufficient hours to keep the wolf from the door. This, while being a philanthropic move and appreciated by the men as such, is also felt by the men to be a hardship, which it certainly is. But with all the dark clouds which have been hanging over the workman's home there is the inevitable silver lining—practically every storehouse is empty or drawing in that direction. A year ago the storehouses were overflowing, but realizing that prices were on the decline the manufacturer was loath to refill them as they began to be emptied.

While some lines were selling fairly well to such customers as were willing to pay the price in order to have the use of the article, there were other lines which sold slowly because the prospective buyer was waiting for the price to drop. He will, however, have to buy sooner or later, and from present indications the next two months will find prices pretty well stabilized and things moving in good shape.

This, at any rate, seems to be the view of the manufacturers visited during the last month. They are all having their shops cleaned up and embellished, while plans are all made and floor space arranged for new units of equipment as soon as the final word is spoken, announcing that business has been resumed.

Farm implement manufacturers have not, so far, cleared their storehouses,but the coming season will clean them out, as the prices have been modified to satisfy the farmer who feels that he has been badly dealt with since he lost his war-time prices.

All told, everything points to a good summer and to a busy time next winter. The conduct of the majority of the manufacturers towards their employees during these trying times has been most commendable and has done a lot to strengthen confidence in each other and it is to be hoped that this feeling will continue and that the coming spring will witness no strikes and no lockouts.

The feeling which has been animating the better instincts of the leading nations of the world at the Washington Conference can be worked to equally good advantage in labor disputes if both parties will see the ridiculousness of strife and try to work in harmony. If we can get past May day without trouble we are in for a long spell of prosperity.

Is It Worth While?

A SUBJECT which we frequently discuss and which would have been dealt with in the present issue had space permitted, is that of laying out gearing. This may not be a foundry proposition and according to some authorities is not a pattern maker's subject either, but with this last argument we do not agree. Pattern makers in large numbers insist on having this published, while others ask the question: "How often is a pattern maker ever asked to make the pattern for a gear, let alone lay it out?"

One argument is that a better pattern can be cut from an iron blank on a gear-cutter and that the maker of the cutting tool does the laying out. This sounds very plausible, but as a matter of fact there are few cut gear patterns, and fewer shops where a gear-cutter is to be found. There is no doubt about the excellence of a cut pattern but its advantages are not as great as would at first appear. Its cost is enormous, compared with that of a wooden one, as the pattern for the blank is the same as that of the finished gear, with the exception of the teeth, and when cast it has to be turned all over in an iron-lathe and bored to fit a mandrel which holds it in the gear-cutter. Gear-cutting to be done economically is done in quantity—a dozen or more on the mandrel being cut at the same time—so that when the cutter is finishing a tooth on one it is starting a tooth on the next one.

In cutting a single one for a pattern the milling cutter makes several revolutions before it gets fairly into a tooth and the same in finishing, so that to cut a single gear is about double the work it would be for each one in a batch. Another point to be reckoned with is that a standard cut gear is not suited for a pattern. In our issue of August, 1921, we published a table for laying out cut gear patterns and gave the reasons for same.

The only arguments advanced in favor of cut gearing is that it can be cut perfect, whereas cast gearing can not be depended on, even in the hands of expert molders, and the best of patterns, because molding sand will yield. This argument is equally forcible, with cut patterns as with wooden ones. However, letting cut patterns have all the credit which is due them, there is always a demand for wooden gear patterns, and if a pattern maker aims to be an A 1 man, capable of accepting any position which may be offered, he should understand gearing. The drawback to all trades is that workmen are willing to specialize on simple parts of the trade and let the difficult work go by, but that is not the way to keep the world supplied with first class-mechanics.

In our school days we were taught that the main advantage to the average boy in learning geometry, algebra, and statics was to exercise the brain so that when he became a man his brain would be sufficiently developed to cope with difficult problems. The same argument holds good in learning a trade. A mechanic should know all about curves and hitches and everything else that he has a chance to learn. It will all come in handy if he is to be a first-class man. The same knowledge which is gained by learning to lay out gears will be useful in other work. So it is with making patterns for propellers. If a man gets so that he can master the making of a pattern for a propeller or the strickles, etc., for molding a propeller without a pattern, the problems which he was forced to solve will help him in solving entirely different propositions.

There is always the possibility of a good position being offered to men who can accept orders from customers who do not know exactly what they want. An improvement might be in order on a machine and the man who can point to certain gears which should be changed, without changing the rest of the mechanism, will be a valuable man on the job. It is a safe guess that there is not one out of a dozen modern mechanics who knows the meaning of "involute," or "epicycloidal," to say nothing about laying them out. Tables, charts, formula, etc., are convenient at times, but there must always be men capable of devising these tables, etc., so why not be one of this class? By all means go the limit in gaining knowledge and it will never hurt you.

The foundry also has problems which are just as perplexing as those of the patternmaker. Molders and foremen will try one experiment after another in endeavor to overcome defective castings, whereas if they knew what caused the defect and the remedy for that particular brand of defect there would be no ocassion to experiment. There are no troubles in the foundry but what have been overcome by someone else, so why not use his remedy instead of going through all the failures he went through in order to arrive at the results?

It is not the intention to discourage experimenting, but experimenting should be done on inexpensive pieces and at opportune times, not on difficult work that is holding back an anxious customer. It certainly is worth while to know and to continue to add to what you know.

Foundrymen's Convention at Rochester

IN OUR November issue we published a somewhat lengthy announcement to the effect that the American Foundrymen's Association would hold their convention and exhibit at Cleveland during the month of April, but unavoidable circumstances have altered the program. The announcement published elsewhere in this issue will explain the reason for changing the location to Rochester, N. Y., and the date to June.

While Cleveland would have been all right as a location, it has no advantage over Rochester. Both are ideally located from a Canadian standpoint and both are good foundry centers, equally accessible from all points in the United States. The change in date is, however, a decided advantage. April was probably chosen in order to get a good early start, but it is not a desirable time of year for a convention; cold rains would, in all probability, have marred its success. June, on the other hand, is the one month in the year when life is really enjoyable in our latitude, when the last thought of winter has vanished and before the hot spell arrives.

Rochester is one of the noted tourist resorts of America with lines of boats running from Cobourg, Ont., and various St. Lawrence River points as well as boat and rail lines from every part of the United States and Canada. It is also convenient as a starting point for boat trips to the Thousand Islands and other beauty spots on the St. Lawrence and the lakes. In future issues we will keep our readers posted on every detail of events in connection with the convention, also with Rochester and with railroad and hotel arrangements. In the meantime we can only say that the convention will be held at Rochester, N. Y. during the week of June 5th, and suggest that as many as possible from Canada arrange their affairs so as to have this week held in reserve for this occasion.

It is quite a while since a convention has been held and the association is sparing no pains to have this one bigger and better than any which preceded it. Mr. C. E. Hoyt, the genial secretary of the association, says that except for the annoyance and embarrassment caused by the necessity of changing dates they are not at all concerned over the situation. Rochester is a very attractive location and he considers that it should prove to be more convenient for Canadian foundrymen than Cleveland would have been. In looking over the map we are inclined to agree with him, particularly from our own personal standpoint, since Rochester is just at our front door with nothing but the waters of Lake Ontario to divide us, while Cleveland is on the south shore of Lake Erie, also facing some important Canadian points. On the whole, we believe that Rochester has advantages from a Canadian standpoint, while the buildings which Rochester has to offer are unsurpassed anywhere.

The Price Argument

WHILE PRICE is generally looked upon as an important factor in present day merchandising, there are some authorities who contend that price should be mentioned last and least in order that the sale of goods shall be on such a basis that there will be a reasonable profit. Recent developments have been of a very indefinite nature in this regard, some retailers holding up price recessions made by other branches of the trade while others are cutting prices to the lowest possible level in an endeavor to stimulate turnover. From the standpoint of economics it is evident that neither course is likely to be very much help in effecting a rapid readjustment of conditions. The first course shakes confidence among buyers and tends to increase the determination to hold off buying of everything, including many necessities. The latter course reminds one of the short-sighted merchant who thought he was doing a big business by constantly keeping his store filled with customers, but who was selling at such a narrow margin that when he came to figure up overhead expenses he found he had been selling at a loss, to say nothing of his waste of energy and time.

Retail experience proves that it is not mere cheapness that builds up any business, in fact with the recent declining market in evidence it has been shown that cutting prices does not necessarily increase trade. Is it not true that the largest shop in every town frequently has a reputation for being slightly dear?

As a general thing it is best to build up business on the basis of the desirability of the goods rather than low price, and every retail merchant should keep this fact in mind in times like the present when the temptation is to offer goods at prices very close to the cost in order to try to stimulate turnover. There should be no slackening off in selling effort but it should be applied to the other phases of the question and not concentrated on price.

An interesting competition was recently organized in Great Britain. Prizes were offered for suggestions for novel uses of india rubber. About 10,000 suggestions were sent, the first prize being awarded for the suggestion of using sponge rubber for general upholstering purposes, including the making of mattresses. Another prize suggestion was that rubber should be included in liquid form with paint or other composition for use in the preservation of wood and metals against the action of the sea. A third prize was given for the suggestion that rubber should be used for general decorative and preservative purposes.

The American Radiator Company, Brantford, Ont., had a very successful season last year. Their storehouses which were overflowing with goods ready for the market have been emptied and they are now running full capacity five and a half days per week stocking up preparatory for the busy season which will soon be opening.

* * *

The Goldie & McCulloch Co., Galt, Ont., have just filled an order for two large propellors to be shipped to a South American port. Who says that Canada cannot sell in the foreign market? And that marine work is not for the Canadians? This company is also building a large pump for the Montreal water works.

* * *

Foundry Reopens at Sarnia. The Holmes Foundry Co., who make a specialty of automobile cylinders and cylinder heads have reopened after a winter's vacation. Some fifty hands are employed in the present foundry, but it is the intention to employ more hands in the near future when additional buildings will be constructed. These however will not be gone on with at the present time.

* * *

London Pattern Shop Blaze:—Early in the morning of Sunday, Jan. 29, fire broke out in the Pettet pattern works, 665 Dundas St., London, Ont., but was extinguished by the firemen before doing much damage. The blaze which started in some rubbish which had been allowed to remain too close to the stove was making a fair start towards destroying the building when discovered.

* * *

The Bluebird Corporation, Limited, Brantford, Ont., manufacturers of the "Bluebird" electric washing machine, are in operation again after a shut down in which a lot of changes were made in their management and a thorough organization of the selling staff. They have quite a stock of partly built washers which are being completed which gives them a much greater output than their staff would be able to produce. As these are finished the staff is increased to keep up the production on machines which have to be built complete. Mr. Dearl, the sales manager, reports that their sales so far this year are far in excess of what they were this time last year. They are preparing for a busy season. Mr. J. B. Detwiler is president of the company.

Wallace & Tiernan have issued a bulletin describing their chlorination process as applied to drinking water, which is made in sizes suitable for municipalities or individual plants. The bulletin is entitled "Is Your Own Town on the Map?"

* * *

Industrial Works, Bay City, Michigan is distributing free upon request Catalog, No. 113, illustrating and describing the Type BC "Industrial" Crawling Tractor Crane of 20,000 pounds capacity.

This Crane is pre-eminently adapted to the needs of road contractors, lumber and coal dealers, gravel, sand and stone producers, foundries, railroad reclamation and storage yards, and moderate-size manufacturing plants.

* * *

Scale Works Busy.—The Brant foundry which was recently put into operation as an auxiliary to the Brantford Scale Works is busy. They manufacture a line of scales and other specialties and report that they have never felt any particular falling off in business and that now they are getting busier. They are doing a nice export trade and are just finishing a good order for Australia. Mr. L. M. Baldwin is the superintendent and Mr. Robert Hartley is foundry foreman.

* * * *

Dresden Foundry Burned:—At an early hour on the morning of Jan. 15 the buildings known as the Meredith Foundry at Dresden, Ont., were completely destroyed by fire. This property while originally a foundry was dismantled as such a few years ago and turned into a garage, so that its loss does not constitute a loss to Canada's foundry list. A new machine-shop was opened in that town a few months ago and is receiving abundant orders, and a foundry would do equally well if operated by a practical foundryman as there is a good opening.

* * *

Monitor Store Co. Busy.—The Monitor Stove Co., who work in conjunction with B. Bell and Sons, of St. George, have had a busy season and as a consequence are building a new storehouse, and will soon be adding to their staff of men. This company has been in business in the U. S. for 102 years and are the originators and pioneers in the pipeless furnace manufacturing business. They are well pleased with their "made-in-Canada" departure and are preparing for a large increase in business this year.

Locomotive Works to resume operations.—The Canadian Locomotive Works at Kingston, Ont., which was closed for some time owing to the lack of business on the railroads is preparing to re-open in March. This company has usually been rushed with orders but, like others, had to yield to the conditions and wait for the tide to turn. It is now believed that the depression is over and that when started there will be continued business and that continuous operation will be the order for some time.

* * *

Foundry damaged by fire.—The Glenwood Range Foundry, St. John, N. B., was damaged by fire to the extent of from $15,000, to $20,000 on the night of Jan. 3rd. The damage was mainly done to the molding shop and pattern shop, while the main building which contained the show rooms and offices as well as the store rooms was not damaged by fire, and but slightly damaged by water. The plant was the property of McClean, Holt and Co., and was covered by insurance. It will be rebuilt at once.

* * *

Foundry changes hands.—Canadian Engines, Ltd., Dunnville, Ontario has ceased to exist as an engineering concern, having been sold to the Climax Rubber Company of Canada, a branch of the Climax Rubber Company of Columbus, Ohio. Mr. H. A. Longshore of the Columbus Company is vice-president, while Mr. George H. Orme of Dunnville, who was president of Canadian Engines is president of the rubber company. Inner tubes will be manufactured and it is not yet decided if the foundry will be operated to make their own molds or whether it will be dismantled and used for other purposes.

* * *

Mr. D. W. Clark has resigned his position as managing director of the Canadian B. K. Morton Co., whose head office is in Montreal, and will in future devote his whole time to the interests of the Anglo Canadian Wire Rope Co., Ltd., of which company he is president and general manager.

Mr. Clark is well known throughout the whole Dominion, he having covered it for many years from the Atlantic to the Pacific in the interests of the well known brand of Sheffield Tool Steels manufactured by Messrs. B. K. Morton & Co. of that city.

WILL EXTEND BRASS FOUNDRY

L. Webster of the Brantford Brass Foundry Co., Brantford, Ont., reports that their business has increased to such an extent that the foundry building will be extended as soon as weather permits and that a new buffing department will also be added. In spite of the quiet times they are busy. Their capacity ranges from the lightest casting to those of 160 lbs. They also specialize on aluminum match plates and patterns as well as aluminum castings of every description.

* * * *

Is in the market for a sprue cutter. The Brantford Brass Foundry Co., wish to purchase a machine for cutting brass castings from the gate and report that they have searched every technical and trade paper that they could get their hands on but have not been able to locate anybody who has this line of goods for sale. Surely gate cutters are manufactured, but why their manufacturers do not come out where they can be seen we are not prepared to say.

* * *

New Machine Shop at Dresden, Ont. Herbert Lamb, formerly with Vickers & Maxim, Barrow-in-Furness, Eng., but for the past eight years head road man for The Canadian Fairbanks-Morse Co., Toronto, and W. D. Lawrence of Dresden, have opened a machine shop at Dresden, under the firm name of Lawrence and Lamb. They will specialize on the installation of water-works systems, fire-fighting pumps and apparatus, also individual lighting systems. They have been operating since December 1st and have already booked several good contracts. They are well pleased with the prospects for the coming season.

* * *

Fire Damages Foundry.—Recently an over-heated stove in the office of the Georgetown Foundry Co. at Georgetown, set fire to the building. In attempting to fight the fire, Mr. Hopkins, a member of he firm, and Mr. Allan, the bookkeeper, were severely burned. The office, shipping and pattern rooms were both badly gutted, and but for the prompt action of the fire brigade and their new motor fire truck the whole building would have been reduced to ashes. The destroyed portion will be rebuilt as soon as possible. The loss was fully covered by insurance.

* * *

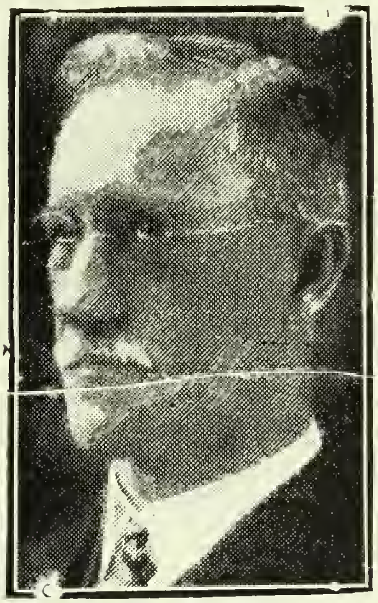
Statuary and ornamental work brisk.—The Canadian Allis-Chalmers Company are busy at their Architectural Bronze and Iron Works, Lansdowne Avnue, Toronto. They have just finished three large bronze statues and have a newly arrived model for another one to be gone on with at once. This is a line of work which they have been following for about a year, and for which they have found a ready sale. They have also booked some good contracts for their regular line of architectural bronze and iron work. One order amounting to between thirty and forty thousand dollars for a Montreal hotel is among the latest to be booked.

OBITUARY

JAMES SHAND

Mr. James Shand, who for many years held the position of superintendent for the Dodge Manufacturing Company, Toronto, died suddenly on the night of Monday, Jan. 30.

Mr. Shand was born in the north of Scotland in the year 1858, and came to Canada when a young man. He was a born mechanic and all his life had been connected with the production of machinery. Before taking over his position with the Dodge Mfg. Co., he was connected with the A. R. Williams Machinery Company.



THE LATE JAMES SHAND

He was married to Nellie B. Quirt, daughter of the late J. H. Quirt. His widow and one son, John, survive him.

HENRY A CARPENTER

Henry Alden Carpenter, aged 55, of the General Fire Extinguisher Co., Providence, R. I., died at his home Jan. 27. He was born in Providence, July 7, 1867. In 1889, together with his father and brother, he established the Alva Carpenter & Sons Foundry Co., becoming vice-president and treasurer. The Carpenter Company was merged with the General Fire Extinguisher Co. in 1911 and Mr. Carpenter joined the new organization, becoming by successive steps manager of the five foundries of the company, including that of the Grinnell Company of Canada, plant manager of the Auburn establishment, member of the executive board, publicity and promotion manager, and a director. He held these offices at the time of his death.

Mr. Carpenter was president of the New England Foundrymen's Association for a number of years. Joining the American Foundrymen's Association in 1896, he was vice-president in 1905 and 1913 to 1916, and was one of the incorporators when the association was incorporated July 3, 1916. Mr. Carpenter was also a member of the National Founders' Association, holding office as vice-president for three years prior to November, 1908, when he became president, succeeding O. P. Briggs. He served as president during 1908-1909.

Always active in city affairs in Providence, he was a member of the city council from 1905 to 1907 and one of the leaders in the Providence Chamber of Commerce, over which he presided in 1917. He was also a director of the Union Trust Co., the Rhode Island Insurance Co. and the Homeopathic Hospital. Mr. Carpenter was prominent in Masonic circles and had held some of the highest offices in the order. He was also a member of the Benevolent and Protective Order of Elks, and among the many clubs, was a member of the Engineers' Club of New York. He was credited with great service in the prevention of fires.

J. T. T. BARKER

John Thomas Tait Barker, who for many years occupied the position of superintendent of the Polson Iron Works at Toronto but who for some time back has been filling a similar position with the Weller and Stairs Co., died at his home, 1562 Queen St. West, on Sunday Feb. 5, from heart failure, after an illness of two years. Mr. Barker was a prominent lodge man, being past-master of St. George lodge, No. 367 A. F. and A. M., companion of Occident and Toronto chapters, Royal Arch Masons, and past-master Toronto lodge, of the A.O.U.W. He was born in England, but had resided in Canada for the last twenty-five years.

METALLIC METEORS FROM COON BUTTE

By A. S. Tronomer.

The meteors which fall from space are, as was pointed out in the last paper, sometimes composed of what was formerly supposed to be pure iron but which are now known to contain other substances. In addition to iron and nickel they contain hydrogen, helium, carbonic oxide, and about the only way in which these gases could have become absorbed in the iron would be through the immersion of the latter while in a molten or vaporized state in a hot and dense atmosphere composed of them, a condition which we know to exist only in the envelopes of the sun, and the stars which we know to be other suns. From this we must conclude that the meteors are offshoots of the sun. The Diablo, as the ancients called them, were evidently supposed to have come from the regions of Diablo (the devil) but we will assume that they come from the sun.

The existence of carbon in the Canyon Diablo meteors is attended by a circumstance of the most singular character—a very fairy tale of science. In some cases the carbon has become diamond. The meteoric diamonds are very small but are nevertheless true diamonds, resembling in many ways the little black diamonds produced by Moisson's method with the aid of the electric furnace. The fact that they are found embedded in these iron meteors is another argument in favor of the hypothsis of the solar or stellar origin of the latter. To appreciate this it is necessary to recall the way in which Moisson made his diamonds. It was by a combination of the effects of great heat, great pressure and sudden or rapid superficial cooling on a mass of iron containing carbon. When the iron was broken open it was found to contain myriads of miniature black diamonds. When a fragment of Canyon Diablo meteoric iron was polished a few years ago it cut the emery wheel to pieces, and an examination showed that the damage had been effected by microscopic diamonds peppered through the mass. How were these diamonds formed? If the sun was the laboratory that prepared them, we can get a glimpse at the process of their formation. There is plenty of heat, plenty of pressure, and an abundance of vaporized iron in the sun. When a great solar eruption takes place, masses of iron which have absorbed carbon may be shot out with a velocity which forbids their return. Plunged into the frightful cold of space, their surfaces are quickly cooled, as Moisson cooled his prepared iron by throwing it into water, and thus the requisite stress is set up within, and, as the iron solidifies, the included carbon crystallizes into diamonds. Whether this explanation has any truth in it or not, at any rate it is evident that iron meteors were not created in the form in which they come to us, they must have been at one time, parts of immeasurably more massive bodies than themselves. Meteors striking our earth would be a decided menace to the populace were it not for the fact that out atmosphere acts as an effective shield. In the absence of atmosphere, not only would more of them reach the ground, but their striking force would be greater, since the larger part of their original velocity is destroyed by the resistance of the air. A meteor weighing many tons and striking the earth with a velocity of twenty or thirty miles per second would cause frightful havoc.

It is a singular fact that recent investigations prove that an event of this kind did happen on the North American continent not many thousand years ago. The location is in the State of Arizona, at a place called Coon Butte where there is a nearly circular crater in the middle of a circular elevation or small mountain. The crater is nearly a mile in diameter, and the surrounding rim, like battlements, rises one hundred and sixty feet above the plain. The crater is about six hundred feet in depth, from the rim to the floor of the crater. It is called a crater because originally it was supposed to be the remains of a volcano, but drillings and other tests have exploded this theory and shown that no volcanic action ever took place in that neighborhood. The rock in which the crater is made is composed of horizontal sandstone and limestone strata. Between three and four hundred million tons of rock fragments have been detached, and a large portion hurled out of the crater. The fragments lie distributed around the crater, and in large measure form the elevation known as Coon Butte. The region has been famous for years on account of the masses of meteoric iron found scattered about and known as the "Canyon Diablo" meteorites. It was one of these masses, which consist of nickel-iron containing a small quantity of platinum, and of which in all some ten tons have been recovered for sale to the various collectors throughout the world, that as before mentioned destroyed the grinding-wheel through the cutting power of its embedded diamonds. These meteoric irons are scattered about the crater-hill in concentric distribution, to a maximum distance of about five miles. The idea is that the meteor weighing many tons became heated away above the melting point and struck the ground with such force that it tore up the earth and rock to a depth of several hundred feet and being in a molten state itself it splashed over the entire region for a distance of several miles. There is no theory or guess work about this. The proof is there to be seen, and the museums of the civilized world are also at the disposal of doubters.

WHAT THE AMERICANS ARE DOING FOR SAFETY

Although it is known that the metal-working industry has, because of the inherent hazards of its nature, always been among the leaders in industrial safety, it has never been established definitely how many persons in the metal-working industry are engaged in accident prevention and industrial health work, or how this industry compares with other industries in this respect. All this will soon be shown when a census of safety men in the metal-working industry, which is now being taken by the National Safety Council along with the census of safety men in all other industries and in public safety work, is completed.

This census will give a good indication of the extent of safety and health work in metal working plants all over the country and will afford the first basis of comparison with the similar work being undertaken in other industries. This is the first time that any attempt has ever been made to list the thousands of people who are now professionally engaged in the safety movement. The census will include not only members and employes of members of the National Safety Council, but all persons engaged in safety and industrial health activities and not connected with the council at all. Most of the principal metal-working plants are members of the National Safety Council.

(Continued in next issue)

SOME COPPER MINE

An American paper published in Cleveland, and touching considerably on foundry practice, reports that one of the most promising copper deposits ever discovered in the United States has recently been unearthed on the west coast of Newfoundland.

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ANODES, BRASS, COPPER, NICKEL AND ZINC
W W. Wells, Toronto, Ont.

ARGGON
Dominion Oxygen Co., Toronto, Ont.

BENCH RAMMERS
I. Johnson & Son, Ltd., Toronto.

BLAST GAUGES
Clark Blast Meter Co., Gladbrook, Iowa.

BRASS FURNACES
Hawley Down Shaft Furnace Co., East- [illegible]

CHAPLETS
Wells Pattern & Mach. Works, Toronto, Ont.

CHEMISTS
Charles C. Kawin, Chicago, Ill.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Indiana

CORE MACHINES
American Foundry Equipment Co., New York City.

CORE OVENS
Damp Bros., Mfg. Co., Toronto, Ontario.
Monarch Engineering Mfg. Co., Baltimore, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.

CORE PLATES
Damp Bros., Mfg. Co., Toronto, Ont.

CORE SAND
Benson & Patterson, Stamford, Ont.
George F. Pettinos, Philadelphia, Pa.

CRANES
Northern Crane Works, Ltd., Walkerville, Ont.

CRUCIBLES
Joseph Dixon Crucible Co., Jersey City, N. Y
J. H. Gautier & Co, Jersey City, N. Y.

CUPOLAS
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co, Cleveland, Ohio.

CUPOLA LININGS
Whitehead Bros., Buffalo N. Y.

DUST ARRESTERS
W. W. Sly Mfg. Co, Cleveland, Ohio.

EDUCATIONALISTS
McLain's System Inc., Milwaukee, Wis.

ELECTRIC RIDDLES
Great Western Mfg. Co.
Preston Woodworking Co.

ENAMEL WARE
Crane Limited, Montreal, Que.

FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FIRE BRICK
Bailey & Bell Firebrick Co., Toronto, Ont.

FLASKS
I. Johnson & Son, Ltd., Toronto.

FLASKS, SNAP
American Foundry Equipment Co., New York City.

Directory of Foundry Supply Houses

The Buyers Directory of Canadian Foundryman was originally intended to contain information regarding lines in the production of which the advertisers actually specialized. We now carry the advertising of leading supply houses, some of whom represent scores of manufacturers, in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the supply houses so we recommend that for all general requirements our subscribers communicate with the supply houses listed below:

The Hamilton Facing Mill Co., Limited, Hamilton, Ont.
George W. Kyle & Co., Inc., New York, U. S. A.
Frederic B. Stevens, Windsor, Ont.
The E. J. Woodison Company, Limited, Toronto, Ontario; Montreal, Que.

FLASKS, STEEL
American Foundry Equipment Co., New York City.
Sterling Wheelbarrow Co., Milwaukee, Wis.
Trussed Concrete Steel Co., Walkerville, Ont.

FLUXES, IRON, BRASS, ALUMINUM, COPPER
Basic Mineral Co., Pittsburgh, Pa.

FLUOR SPAR
Basic Mineral Co., Pittsburgh, Pa.

FOUNDRY ENGINEERS
Charles C. Kawin, Chicago, Ill.
H M. Lane Co., Detroit, Mich.
McLain's System Inc., Milwaukee, Wis.

FURNACES, OIL
Hawley Down Draft Furnace, Easton, Pa.
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES, GAS
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES COKE
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES ELECTRIC
Volta Mfg. Co., Welland, Ont.

GRINDERS, PORTABLE
A. W. Sainsbury, Ltd.
Cleveland Pneumatic Tool Co., Cleveland, Ohio.

GRINDERS, SWINGING
A.W. Sainsbury Lt., Sheffield, England.

HEATERS
E. J. Woodison & Co., Toronto,

HEATING SUPPLIES
Crane Limited, Montreal, Que.

HOSE COUPLINGS
Cleveland Pneumatic Tool Co., Cleveland, Ohio.

INDUSTRIAL ENGINEERS
H M. Lane Co., Detroit, Mich.

KAOLIN
Whitehead Bros., Buffalo N. Y.

LADLES
Damp Bros., Mfg. Co., Toronto, Ont.

LADLE SHANKS
Damp Bros., Mfg. Co., Toronto, Ont.

MAGNETS
Dings Magnetic Separator Co., Milwaukee, Wis.

MAGNETIC SEPARATORS
Dings Magnetic Separator Co., Milwaukee, Wis.

MALLETS
I. Johnson & Son, Ltd., Toronto.

METALLURGISTS
McLain's System Inc., Milwaukee, Wis.
Charles C. Kawin, Chicago, Ill.

METAL PATTERNS
Bryant Pattern Works, Windsor, Ont.
Hamilton Pattern Wks., Toronto, Ont.
I. Johnson & Son, Ltd., Toronto.

MOLDING MACHINES
American Foundry Equipment Co., New York City.
Benson & Patterson, Stamford, Ont.
Grimes Molding Machine Co., Detroit, Michigan.
Herman Pneumatic Tool Co., Pittsburgh, Pa.
Osborn Mfg. Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
W. H. Nicholls, Brooklyn, N. Y.

MOLDING SANDS
Whitehead Bros., Buffalo N Y.
A. MacMillan, St. Catharines, Ont.
Benson & Patterson, Stamford, Ont.
Geo. F. Pettinos, Philadelphia, Pa.
Venango Sand Co., Franklyn, Pa.

OXYGEN
Dominion Oxygen Co., Toronto, Ont

PATTERN MAKERS
Bryant Pattern Works, Windsor, Ont
Hamilton Pattern Wks, Toronto, Ont
I. Johnson & Son, Ltd., Toronto.

PIG IRON
A. C. Leslie & Co., Ltd., Montreal.
Steel Co., of Canada, Hamilton, Ont.

PIPE FITTINGS
Crane Limited, Montreal, Que.

PLUMBING SUPPLIES
Crane Limited, Montreal. Que

PNEUMATIC TOOLS
Cleveand Pneumatic Tool Co., Cleveland, Ohio.

PULLEYS
Dings Magnetic Separator Co., Milwaukee Wis.

RIDDLES
Great Western Mfg. Co., Leavenworth, Kansas.
The Preston Woodworking Machine Co., Preston, Ont.

SAND
Benson & Patterson, Stamford, Ont.
Dick Sand Co., Franklin, Pa.
George F. Pettinos, Philadelphia, Pa.
Venango Sand Co, Franklyn, Pa.
Whitehead Bros., Buffalo N. Y.

SAND CUTTING MACHINES
American Foundry Equipment Co., New York City.

SAND MIXERS
Frost Mfg. Co, Chicago, Ill.
National Engineering Co., Chicago, Ill.

SAND SIFTERS
Great Western Mfg. Co., Leavenworth, Kansas.
National Engineering Co.
The Preston Woodworking Machine Co., Preston, Ont.

SAND BLAST MACHINERY
American Foundry Equipment Co., New York City.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.

SAND MULLERS
Frost Mfg. Co, Chicago. Ill.
Nationa Engineering Co., Chicago, Ill

SANO BLAST ABRASIVES
George F. Pettinos, Philadelphia, Pa.
Globe Iron-Crush & Shot Company, Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND RAMMERS
Cleveand Pneumatic Tool Co., Cleveland, Ohio.

SANITARY EQUIPMENT
Crane Limited, Montreal, Que.

SNAP FLASKS
American Foundry Equipment Co. New York City.
Damp Bros., Mfg. Co., Toronto, Ont.
Diamond Clamp & Flask Co., Richmond, Indiana.
I. Johnson & Son, Ltd., Toronto.

SNAP FLASK JACKETS
Damp Bros., Mfg. Co., Toronto, Ont.

STEEL BANDS
Damp Bros., Mfg. Co., Toronto, Ont.

TUMBLING BARRELS
R. MacDougall Co., Galt, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.

VALVES
Crane Limited, Montreal, Que.
Cleveand Pneumatic Tool Co., Cleveland, Ohio.

VENT WAX
United Compound Co., Buffalo, N. Y.

WASH ROOM FIXTURES
Crane Limited, Montreal, Que.

WELDING AND CUTTING SUPPLIES
Dominion Oxygen Co., Toronto, Ont.

WHEEL BARROWS
Sterling Wheelbarrow Co., Milwaukee, Wis.

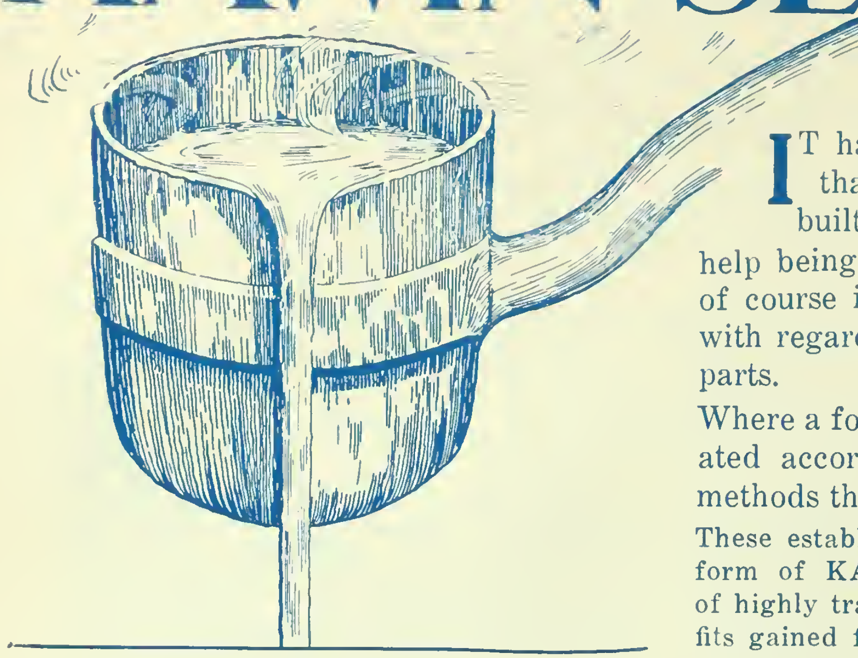
INDEX TO ADVERTISERS

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England.

Vol. XIII Publication Office, Toronto, March, 1922 No. 3

KAWIN SERVICE



IT has always been a logical theory that where an automobile has been built "from the ground up" it can't help being a mighty fine car. The reason of course is that every part is constructed with regard to its relationship to the other parts.

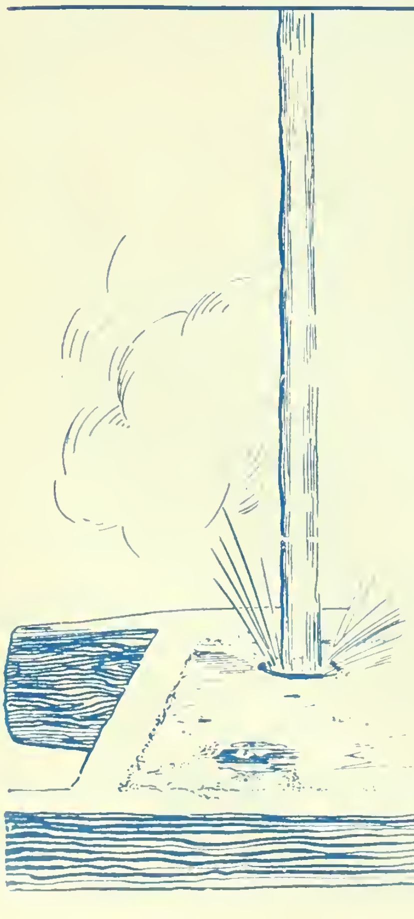
Where a foundry is planned, built and operated according to definite pre-established methods the same is bound to hold true.

These established methods you can use in the form of KAWIN SERVICE—an organization of highly trained men giving you all the benefits gained from 20 years practical experience with foundry problems of every kind.

Think what this means to your business. It means that when you want alterations or new equipment you are guided by the most approved methods known to foundry practice. It means that at all times you have expert advice on up-to-date cupola practice, on the economical purchase of raw materials, on the chemical analysis of your mixtures—in fact on every subject that may arise.

Can you afford to be without this valuable advisory service? So successful has Kawin been with other foundries that you are guaranteed a 100 per cent. saving over and above the cost of Kawin Service.

"Building from the Ground up"



Drop us a line and we will be pleased to explain KAWIN SERVICE more fully. It will in no way obligate you.

Chas. C. Kawin COMPANY

307 Kent Building, Toronto

Chicago, Ill. Cincinnati, O. Buffalo, N.Y. San Francisco, Cal.

Chemists--Metallurgists Foundry Engineers

PRESTON

Ball Bearing Electric

SAND RIDDLE

No Overhead Equipment Required With this Riddle

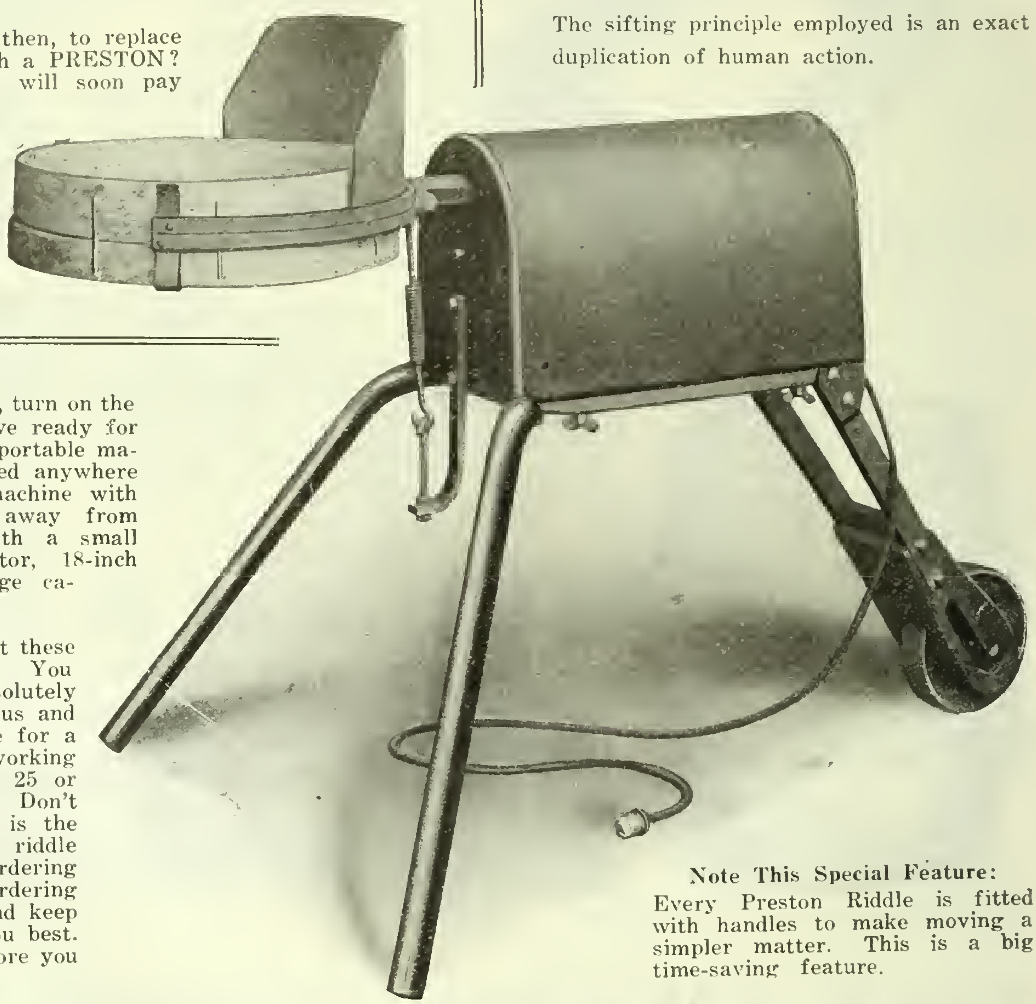
Run it Where You Like It Will Take Care of Your Whole Moulding Shop

Isn't it economy, then, to replace hand riddling with a PRESTON? The wages saved will soon pay its cost.

is a staunchly constructed, long-lasting machine that produces thoroughly sifted sand at a faster rate than a man can shovel into it.

A man riddling sand by hand frequently stops to rest. The PRESTON never becomes tired and therefore need never stop. Therein lies its big economy.

The sifting principle employed is an exact duplication of human action.



SCREW the socket in, turn on the switch and you have ready for action a light-weight portable machine that can be used anywhere in the foundry; a machine with all parts enclosed, away from dust; a machine with a small power-consuming motor, 18-inch hand riddle and large capacity.

Don't you want to put these features to the test? You can do so — and absolutely without cost. Write us and we will send a riddle for a fifteen-day actual working trial. State whether 25 or 60 cycle is required. Don't BELIEVE that ours is the equal of any other riddle made. Find out by ordering ours **on trial** and ordering any other on trial and keep the one that suits you best. Better write now before you forget!

Note This Special Feature: Every Preston Riddle is fitted with handles to make moving a simpler matter. This is a big time-saving feature.

The Preston Woodworking Machinery Co.

LIMITED

PRESTON, ONTARIO, CANADA

25 Tons Mixed Per Day!

That's a week's work by hand isn't it?
Yet it is the minimum daily output
of the

"MONARCH"

"BLIZZARD"

UNIVERSAL SAND MIXER

(Single Hopper Type "Patented")

THE Universal Sand Mixer and Sifter is a real money-saving machine—a distinct advancement for the handling of sand in the foundry.

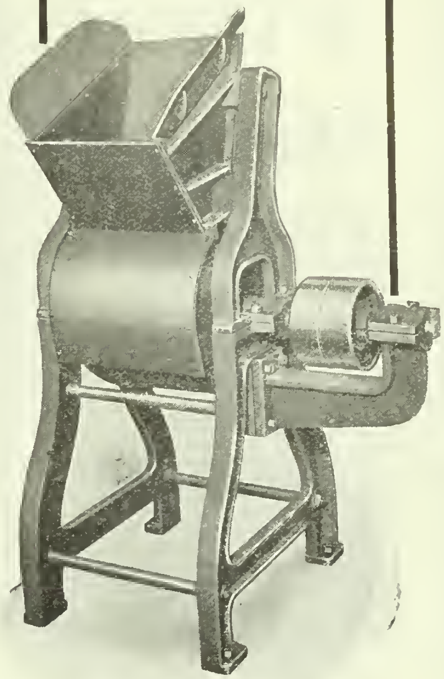
Fitted as it is for motor attachment and ready to be mounted on wheels for quick transportation, its middle name is "speed."

It handles Sand Mixing, Separating and Cutting all in one operation and at low power and labor costs. The sand produced is equal in quality to that passed through a No. 16 sieve.

Universal Mixers are built in Single and Double Hopper Types on strictly safety-first principles. If you are interested in saving money on sand mixing write for our circular.

Mounted on Wheels

Can be easily and speedily moved to any part of the foundry.



A Separator—Cutter —Mixer

Virtually three separate machines in one—but taking up small floor space. Separates nails and foreign matters from sand.

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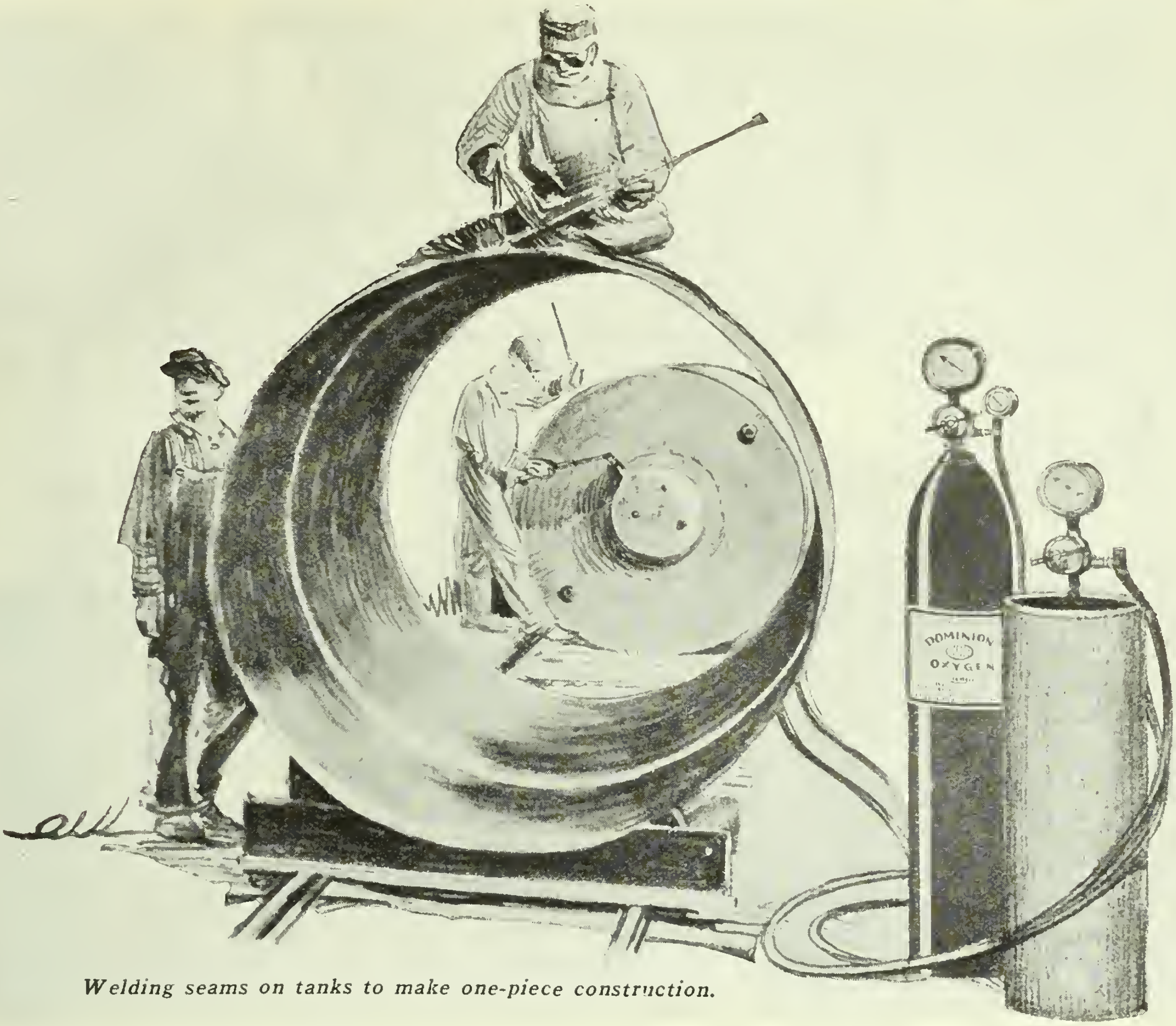

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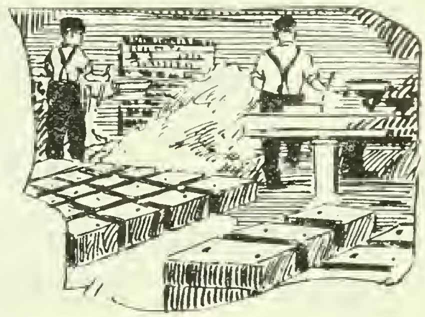

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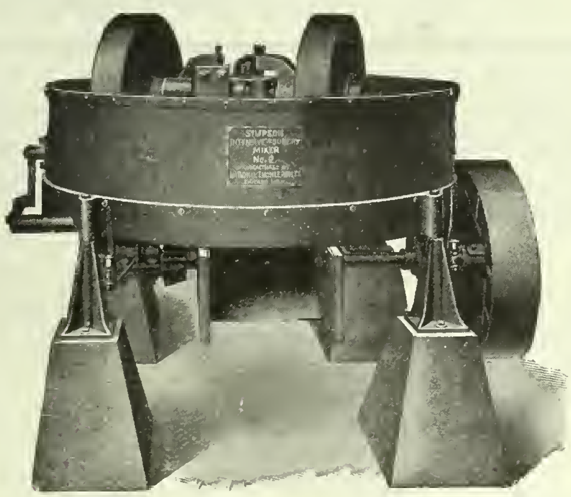

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Save money and labor by not scrapping castings that have small defects that in no way impair their strength.

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CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Member of the "Audit Bureau of Circulations"

Established 1909
Published Monthly

Remodeled Canadian Motor Casting Foundry

Comparatively New Foundry Buildings Entirely Overhauled to Meet the Demand for High Grade Automobile Engine Castings —Making it a Veritable Machine for the Production of Castings

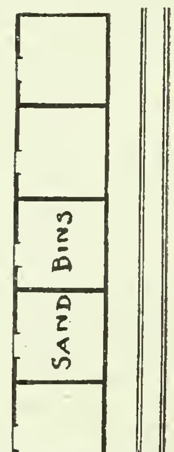
AS AN EXAMPLE of how Canada is forging ahead in the foundry business, the reader is advised to read carefully the following article on a remodelled foundry which has just been put into operation in one of our border cities. It not only shows that we are going ahead, but it shows that we are going in the right direction, and that a foundry to be operated profitably must be operated as a foundry and not as a back yard annex to a machine shop. It also shows that a foundry to be operated as such must be designed and engineered by a foundryman. The manufacturer who looks upon his foundry as a necessary evil deserves to have it be that very thing, but the manufacturer who is wise enough to realize that the foundry is a unit by itself and requires just as much care in designing and equipping as any other department in order to make it a success will be rewarded accordingly.

The following descriptive article not only shows that every move in the operation is a move towards the completion of the job but it also shows that the workmen have been considered. It even shows what we illustrated in our last issue—that a foundry to be up-to-date must have an interior coating of white, which will remain white. The buildings here shown were comparatively new before alterations, but were not what they should be from the standpoint of layout and general efficiency.—Editor.

Hiram Walker & Sons Metal Products Co., Ltd., Walkerville, Ontario, have for sometime had a foundry devoted to allloy and special castings, but it was decided this year to make certain changes in the plant, remove their wire department to another building, build a new special alloy foundry, and change the existing buildings into a motor casting plant, with plans for ultimately extending it to a foundry that would be able to take care of any work that would be likely to come to them.

The general layout and arrangement of the buildings is shown in Fig. 1. The existing brick buildings were used pracally as they stood, the old core ovens and existing equipment were torn out, a set of sand bins had to be constructed on the outside and a melting unit constructed.

The general arrangement of the interior of the main foundry is shown in Fig. 2, which shows the central bay, which is bridged with several underslung Brillion cranes, with Brillion pouring devices for pouring off the work. In the central bay are arranged the moulding machines for cylinder blocks, and crank cases, and at present fly wheels are being made in this bay. The side bay at the left of the illustration is now all utilized for light work, but ultimately will take one of the fly wheel floors. The bay at the right is arranged with about two-thirds of it



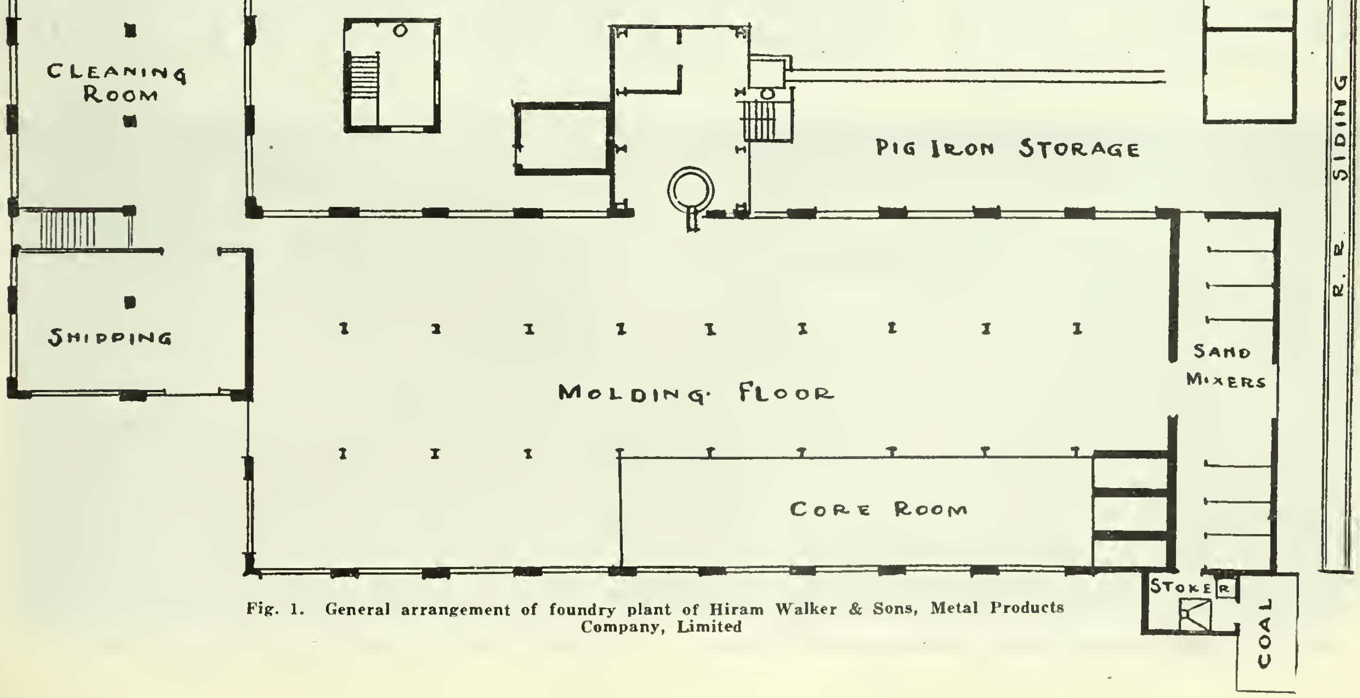


Fig. 1. General arrangement of foundry plant of Hiram Walker & Sons, Metal Products Company, Limited

Fig. 2. Main bay of foundry showing Brillion crane in center

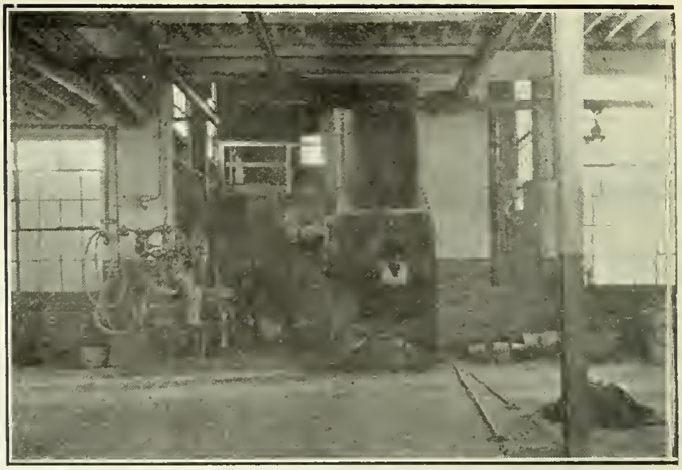


Fig. 3. Front view of melting unit with daubing bench at left

to be used as core room, and the balance as light work floors. The melting unit is placed at one side, at about the middle of the shop, Fig. 3 showing the front of the cupola. The melting unit is a steel structure with a steel charging floor capable of carrying 750 lbs. per sq. ft. The blower is in a separate room back of the cupola, and is a positive pressure blower direct driven by an electric motor, and was made by the P. H. & F. M. Roots Co. The charging floor arrangement is shown in Fig. 4. The stock is brought up to the charging floor on a Whiting pneumatic elevator, and a series of stock piles arranged across the back of the room, containing enough material for one or two day's run. During ordinary running conditions the metal will come up on yard cars, the charges made up on a multiple beam scale shown, piled in front of the cupola, and charged as wanted. This unit is covered with Keasby-Mattison Co. corrugated asbestos, thus giving it a fire-proof outer shell, and the entire structure is so arranged that it can be taken down and moved to another location when it is desired to extend the plant in accordance with plans already worked out. When this is done the present unit will be assembled in connection with a similar unit to be built later, thus giving a larger charging platform and two cupolas.

There is a short piece of hand pushed monorail in front of the cupola for pushing Brillion pouring devices with ladles across to the Brillion cranes, or for handling cupola ladle to supply the hand and shank ladles.

The ladle daubing bench can be seen at the left of the cupola in Fig. 3.

As already stated the core room occupies about two-thirds of one of the side bays, and is at present equipped with three forced draft auxiliary air core ovens, which are stoker fired, the stoker being located in a pit just outside of the foundry wall proper. Fig. 5 shows a view of a portion of the core room with some of the core makers benches and the core racks used for introducing cores into the ovens. The stoker is of sufficient capacity to take care of several additional ovens, which will ultimately be built on to the present battery. The racks are handled by a Sheppard Jack-Lift truck. The core makers make the cores, they are then put on racks, and then the entire rack is set into the oven. After they are dried the rack of cores is taken from the oven, and set along the side of the core room next to the foundry. Such cores as need no special finishing or pasting are taken off and taken directly to the foundry floor, while those that have to be finished or pasted are taken care of and then sent to the foundry floor.

At the back of the core ovens across the end of the foundry there was a low building containing some sand bins and general storage bins. In this building were installed a Sellers centrifugal mixer for facing sand and a Standard Sand & Machine Co. paddle mixer for core stand. Fig. 6 shows the center of the mixing department with the Sellers mixer on the left and the Standard paddle mixer on the right. Each of these machines is driven by its own electric motor. There is a passage between the sand bins and this extension to the foundry proper, which at one end leads out to the outside sand bins, and the yard, and at the other end to the shed over the stoker firing pit, and this passage makes is possible to gather together the various ingredients for the various sand

Fig. 4. Part of the charging platform, showing general arrangement

Fig. 5. Core room with rack type ovens in the rear

Fig. 6. Sand mixing room at the rear of the foundry

mixes, including both sand and binders.

In the ultimate development of the plant it is expected that most, if not all, of the present foundry will become core room, and an additional building will be constructed to take care of the melting and casting.

The castings are shaken out at the end of the foundry furthest from the core ovens, and pass immediately to the cleaning room in the adjoining building. On one side of the cleaning room is a battery of four tumbling barrels, as shown in Fig. 7, and on the opposite side of the room are arranged the grinders and the fan for the dust arrester.

There is an "I" beam trolley running over al' of the mills, which can be used for lifting off the mill covers, and if necessary for lifting in and out heavy castings.

Beyond the cleaning room is a welding room, and also provision for water testing.

The existing building is utilized as cleaning room on the first floor, and on the second story, the floor of which was strengthened, is a room utilized for pattern shop, the arrangement of which is shown in Fig. 8. This pattern shop is equipped for both wood and metal pattern work, and for taking care of its own flask and rigging.

The plant is equipped with an air compressor furnished by the Canadian Ingersoll-Rand Co., and with a sand blast room with dust arrester which were furnished by the American Foundry Equipment Co. The motors throughout the p'ant were supplied by the Canadian General Electric Co. The moulding machines, most of which were furnished by the people for whom the castings are being made, are Osborn machines made by the Osborn Mfg. Co.

The exhaust fan and dust arrester for the tumbling barrels and grinders were furnished by the Canadian Sirocco Co., and the steel work for the charging floor and other features by the Canadian Bridge Co. As already mentioned the charging elevator is a Whiting pneumatic, and the Whiting Corporation also furnished the cupola and three new tumbling barrels.

Attention is called to the fact that the plant has been given a coat of white paint on the interior. This is an oil paint put on with spray, and the dust can be blown off of it when necessary so it will keep the shop white for a long time.

A description of the foundry would not be complete without a word in regard to the operating end. The well-known foundryman, J. J. Wilson, who has had charge successively of the foundries of the Cadillac in Detroit, the Buick in Flint, and the Central Foundry in Saginaw, and who has acted as general foundryman for the General Motors Co., for many years, severed his connections with them sometime ago, and made arrangements with the Walkers to take charge of their Canadian foundry interests. Mr. Wilson's ability as a foundryman is well known, and the success of any enterprise which he takes charge of is assured.

The re-arrangement and construction work was in charge of The H. M. Lane Company, Foundry Engineers, with offices in Detroit, Michigan, U. S. A., and Windsor, Ontario.

PLUMBUM

Lead, one of the commonest of our metals, carries another name which few outside of those interested in chemistry seems to know. This name is "Plumbum." If we read chemistry we see lead symbolized as Pb. and perhaps wonder what it means.

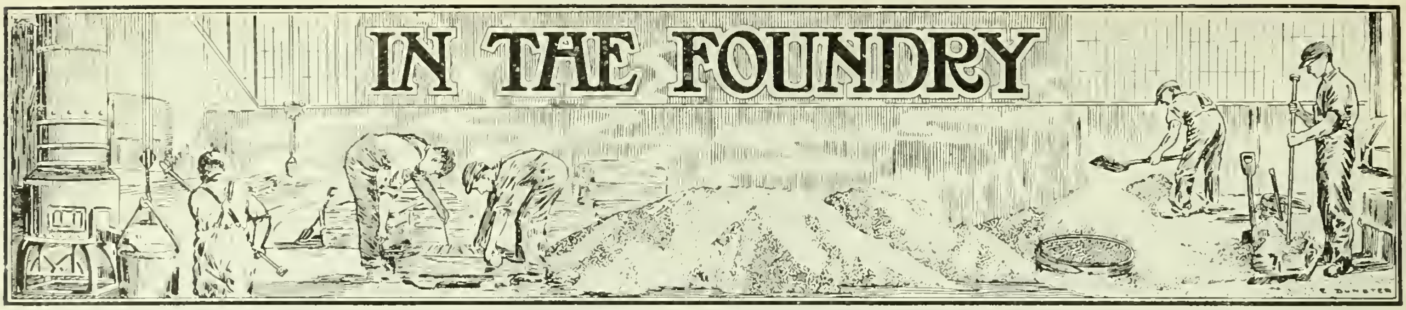
Plumbum is the Latin name for lead, and many words in the English language treating on lead-work have the first syllable of this word incorporated in their make-up. For instance the trade of plumbing is that of working in lead. A plumber is a man who cuts, fits and solders lead pipe, etc. Lead, it must be remembered is one of the oldest of the known metals, and lead pipe was known long before iron pipe was thought of. The ruins of Pompeii still have lead pipe which was in use two thousand years ago.

Again, the word "plumb" gets its origin from the same source. A plumbline is a line with a weight of plumbum attached to it to make it hang per-

(Continued on page 25)

Fig. 8. Wood and metal pattern shop over the cleaning room

Fig. 7. Individually driven tumbling barrels in the cleaning room



The Molding and Pouring of a Caustic Kettle

Outside Swept in Loam—Various Ways of Making Inside and Arranging the Gates—Gating Any Casting an Important Feature

IN THE illustration will be seen a caustic kettle, cast at the foundry of the Dominion Steel Products Co., Brantford, Ont., for the Canadian Salt Co., Windsor, Ont. As will be seen by the number of men who can find lodgment within its spacious interior, it is quite a size.

In making this pot it was known in advance that it must be a sound casting and constructed from material which would resist the action of the caustic soda, which is used in the salt refining process. This was easily accomplished at the above foundry, on account of the equipment which has been installed on purpose for just such orders.

With a twenty-ton Pittsburgh type air furnace, and ladle and crane equipment capable of handling the twenty tons of melted iron, the biggest problems are solved. The special acid resisting metal is charged into the air furnace and when melted it is tested and analyzed before pouring, to be sure that everything is all right.

This kettle was made in a loam mold; it weighed 13 tons and was poured with one ladle.

The molding of kettles is one branch of molding which is especially interesting. Where only one is called for, as in the present case it is swept up without a pattern. An iron plate is placed in the bottom of the pit unless a permanent pit with anchor irons secured is at hand, as was the case with this particular one.

To make a kettle of this kind in an ordinary pit the bottom plate must be big enough to carry the brick wall of the mold and then have lugs for the binding bolts which hold the cope down. The bottom of the mold is really the most important part of the entire mold, as a flat plate is always a difficult casting to save on account of scabs, cold sheets and other defects. Getting the vent away from this part is a most particular feature. After digging the pit, an open mold is made on the bottom for this plate, which is poured right in its place and left there. On top of this the brick wall is built slightly larger than the outside of the kettle, thus allowing room for the loam. Before building the wall a quantity of dry cinders are sifted onto the bottom plate and a course of bricks on edge is laid all over this with nothing but burned out sand and water as a filler. On top of this a plain flat surface is swept off with about a half an inch of loam. This forms the bottom of the mold, and the gas which will be generated escapes through the dry cinders and up through a pipe which must connect this part with the floor level. It is understood, of course that a spindle was plumbed up in the centre to begin with.

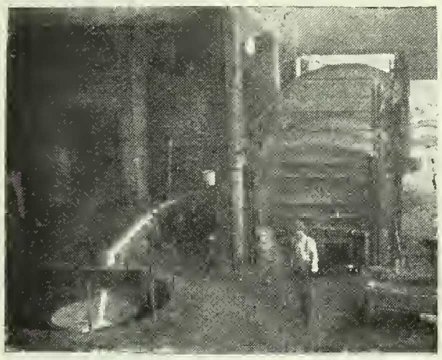
The flat sweep which was used to strike off the bottom is now removed and an upright one fastened to two sweep arms is put in place and the wall built to it. A short cross-piece is attached to the top which strikes off the top of the wall to the exact height for the model. The brick work is kept half an inch back of the sweep and the loam is spread on after each foot of wall is laid. When this is completed and dried the outside of the mold is done.

The making of the inside is accomplished in a number of different ways. It is possible to sweep it up by itself and drop it into the part already described, but as good a way as any is to cast a grid, which is simply an open work lifting plate and put this down into the part which forms the outside and build the inside right in its place. To do this it will be necessary to sweep on the thickness of the bottom and sides with sand and clay wash. This thickness, when dried, will be of the proper dimensions for the inside of the kettle and instead of sweeping a core, the inside can be rammed up with molding sand. Facing sand is sifted into the bottom, and the grid, after being claywashed is let down with three or more long bolts which reach a foot or more above the floor level. Facing sand is now rubbed up against the sides and backed up with heap sand. This is rammed in six-inch layers until the top is reached, when a flat cope is put on and

Thirteen-ton caustic kettle cast at the Foundry of the Dominion Steel Products Co., Brantford, Ont.

the ramming continued. When the cope is put on and the ramming continued. When the cope is rammed the bolts which connect with the grid in the bottom are used to bind the grid and the cope together. The entire cope and inside are now lifted up clear of the outside and moved to one side. The thickness sand is now removed and both parts of the mold are finished. The bottom and outside, which are made in loam must be thoroughly dry, while the inside should be sprayed with molasses water and skin-dried. The mold is now closed and bound down with bolts attached to the bottom plate.

A part of the work which may be done now, but which is better done before lifting off the cope, is that of ramming sand between the brick wall and the wall of the pit. If done while the mold



Catching the molten metal from the air furnace into the ladle

is intact there is less risk of moving any of the bricks. If this space is not securely rammed the brick wall will spread from the pressure of the melted iron.

In ramming up this sand strips of wood should be rammed at intervals against the bricks. These will be withdrawn allowing escape of gas when pouring.

Gating

Pop gates are used. These are distributed around the top about a foot apart, and connected with a runner. If many kettles of this kind are required it is much better to have a complete pattern, when the entire mold can be made in sand. A pattern for a kettle of this kind is not expensive, but where only one is called for, the loam mold is the cheapest. If a complete pattern is used it would not do to use pop gates until after the bottom is covered with melted iron. In such a case a gate is run down on the outside and connected with the bottom. This gate will be made of hollow cores. It is not necessary to make a spreading gate, when the bottom of the casting is an inch or more in thickness. A deep narrow gate which will carry a deep narrow stream across the bottom and not allow the sand to scab and not allow any rings or streaks to form. When it has reached the entire diameter it will spread but in volume; not in a thin sheet which has heat enough to create steam but not weight enough to hold it down. A gate entering the bottom from the outside is a good idea no matter what the mold is made of. When employing an outside gate as well as pop gates, the runner basin should be cut deeper where the outside gate is so that it can be poured from there without the iron entering the pop gates. When the bottom is covered, the entire basin is flooded and all the gates employed at the same time. Plugging the gates is sometimes resorted to, but it is better to leave them open. If the bottom is covered to such a depth as to preclude any possibility of the pop gates cutting it, there is not much other harm which can take place, but where the iron from the pop gates strikes the bottom of the mold, it must strike all around at the same time so as to cushion itself and protect the bottom. The study of gates is one of the chief studies in foundry work.

WHAT THE AMERICANS ARE DOING FOR SAFETY

(Continued from last issue)

Every reader of this publication who is professionally engaged in industrial or public accident prevention or industrial health work—whether he is devoting all or only part of his time to accident prevention—is urged to assist in the taking of this census by sending to the National Safety Council, 168 North Michigan Avenue, Chicago, his name and the other data requested in the Council's census form which is reproduced on this page.

It is expected that when the job of taking this census is completed there will be registered at the headquarters of the National Safety Council in Chicago the name of every man and woman responsible for the safety work of every industrial plant, public utility, municipality, and every organization which devotes any part of its efforts towards the promotion of either industrial or public safety, in the United States. Up to the present date there has not been in existence any data to show how many persons are engaged in this work either in any single industry or class or in the country as a whole.

Industry in general and the nation at large will profit from the results of this census. It will enable the council to quickly find speakers on industrial and public safety for any occasion in any locality; authors for special articles on accident prevention; writers of safety textbooks; lecturers on accident prevention and industrial health work for universities and colleges. The council at present continually receives requests from industrial companies, municipalities, civic associations, clubs, schools, colleges, and other organizations for help in finding speakers or writers on safety subjects. The census records will greatly increase the facilities of the council for filling such requests.

Following is the form which all safety workers are requested to fill in and send to the National Safety Council, 168 N. Michigan Ave., Chicago.

Name ....
Company or organization ....
City .... State ....
Nature of company's business ....
Is safety your principal work? ....
Please check other activities you engage in:—

Fire protection
Health and sanitation
Workmen's compensation and claims
General executive (such as manager or superintendent)
Engineering (other than safety)
Legal
Insurance
Welfare
Educational
Industrial relations

How long have you been in your present position? ....
Technical or other special education?....
Signed ....
Title ....

THE MOLDER AND THE OTHERS

Joseph G. Horner says that the old race of millwrights were "all round" men in the engineering field. They could fit up a mill throughout, design its arrangements both general and in detail, make the patterns for the cast iron work, cog up the mortise wheels, chip and file the iron-toothed ones, weld a shaft, turn it in the lathe, forge levers, fit up the pedestals and bearings, line the shafting, and, in fact do all the work that is now divided among half-a-dozen separate and distinct trades.

This is all true. The old-fashioned mechanic was a general purpose man but he did not include molding in his list of occupations. The man who can mold successfully does not have any other profession hanging to him, although there are those who maintain that they can "break in" molders. They may maintain this but they are not doing it. Molding is a trade which has no resemblance to any other calling, and must be learned. There are undoubtedly men to-day who could do a fair job in the machine shop and also in the blacksmith shop, but molders are in a class by themselves. Molding is one of the oldest of trades, and was always held in high esteem until lately. Now the order is to have Technical schools for teaching students to run automatic machines, while molding is to be left for the "Hunkeys" who have been "broke in." But wait a few years and see who will command the biggest and be the most sought after,—the technically educated machine operator or the first class practical molder.

NICKEL MARKET IMPROVES

Sudbury, Ont. —Home from Britain, where he was in consultation with the head office, C. V. Coreless, General Manager of the Mond Nickel Company's operations in Canada, stated that mining and smelting operations of the Mond will not be any further curtailed. The company believes that the corner has been turned in the present state of the metal market and world conditions generally, and if things don't get any worse the company proposes to "fight it out."

Sweeping a Propeller in a Brick and Loam Mold

Cope Flask May Be Made Up From Iron Plates and Bars While Grid and Cover Plate May Also Be Used—Gating at Bottom of Hub

By F. H. BELL

IN the January paper we published a sort of rudimentary description of how a propeller is swept up in loam without any pattern, other than sweeps and an iclined guide. In this article it was shown that the wheel might be made with the face side down or up as desired, the latter being the method shown. It was also shown that the hub could be swept as the work proceeded, or a dummy pattern swept up, the latter being the one adopted.

In Feb. we described and illustrated the part taken by the pattern maker on a job of this kind, while also showing the alternative method of molding—that of casting the face downward and sweeping the hub. It must be remembered that the hub is partly in the nowell and partly in the cope, no matter which side is cast uppermost and it makes little difference which way is adopted, although the dummy would probably be most suited to medium small wheels, while sweeping would be best for larger ones. If sweeping is adopted the portion which is in the nowell is made in the rough to slightly above the proper size and is finished when sweeping the copes.

In the present article it is proposed to show in detail the British method of molding, in which it will be seen that the best shops in England, still adhere to some of the features which have made them famous but which are slighted on this side of the water, such as baking the brick work and the rough coat of loam before finishing the mold, and gating from the bottom of the hub. It should be noted that the mold described is to be poured with bronze, but the mold and rigging is the same as would be used for iron. It will also be realized that the rigging required for this mold is essentially the same as would be used if the mold was made the other side up. The following is essentially a continuation of last month's paper on the pattern maker's part in making such a mold.

For the moulding of a solid propeller a circular cast-iron moulding-plate (thickness 2½ in.—3 in.) is first chosen, of a radius about six or seven inches less than that of the pitch-piece to be used with it, and about four to six inches greater than the radius of the propeller; the plate is then mounted on a permanent foundation called the "bed." By bolting three or four L-irons to the bed, so that the plate fits between them, the replacement of the moulding-plate in exactly the same relative position to the bed is easily accomplished.

All moulding-plates are designed so as to be quite rigid when lifted. The accuracy of pitch in a mould is seriously affected by a springing plate.

Into the centre of the moulding-plate is screwed a steel spindle furnished with, (a) a strong metal bracket-arm to carry the striking board, (b) a strong metal ring or collar fitted with a securing-screw to hold the boss-board, (c) a revolving cap, complete with pulley-wheel, cable and balance-weights to support the weight of the striking-board. (See sketch 2.)

The striking-board is bolted to the arm so that the leading or forward side of the striking-edge is exactly radial to the axis of the spindle. The board is then adjusted with a spirit-level to assure of its being quite horizontal, or at whatever angle the "drop" requires.

A suitable iron spike is then screwed point downwards to the end of the striking-board, and a circle is traced out on the floorplate which has been chalked over for the purpose. The circle is carefully divided into three or four parts (according to the number of blades) using a large pair of compasses. The radii extending to these points are plainly marked on the upper surface of the moulding-plate and on its edges, and these indicate the centre lines of the blades. The spike is then removed.

The pitch-piece is fitted round the moulding-plate at the known radius, and the roller of the striking-board adjusted to run centrally on the rail, while the centre point of the pitch-piece (distinctly marked in the pattern-shop) is so placed as to meet the extended radius of the centre-line of a blade. The pitch-piece is then clamped or securely weighted to the floor.

In the photographic view Fig. 1 will be seen how the mold appears. The open work affair to the right is the pitch-piece and is similar to the one described in our Jan. paper. The floor on which it is shown resting is the bed or floor-plate which remains permanent. In case a suitable sized molding plate is not in stock a smaller one with pieces bolted to it as in the illustration is equally as good.

A fore-and-aft projection of a blade is now outlined on the plate, round one of the centre-lines. This is done by using strips of wood cut to the half-length of sections: these are held from the striking-edge to a set-square placed in the centre-line and marked to the height of the bed-mould; a plumb-line hung from the striking-edge gives the projected outline on the bed-plate. The edges of the mould are allowed four to seven inches around the blade projection, and this final outline is marked with chalk; ample allowance is thereby afforded for the seating of the "cope," i.e., the top portion of a mould, and for the overlapping of wide blades. The final mould-area is templated with iron rods so that the remaining blades can be easily marked out

First Course

The actual building of the mould follows the usual practice of brick and loam-moulding. The bed-moulds of the blades are built up successively, moving the pitch-piece as required; the bricks should not be closely packed, but left fairly open so that the loam may dry more quickly. The nature of the loam is a very important point. Its behaviour depends largely upon the amount of clay constituent in the sand from which it is made. The loam must be kept as "open" and porous as possible. The blade-moulds are thus built and roughly struck up with a loam facing, provision being made both for the runner and the necessary test-bars.

The runner is moulded in loam, also a piece of gas-barrel being used as a pattern. A stock of tubes of varying lengths and diameters, covering a range suitable for the largest to the smallest propeller, is held in the charge of the foundry store-keeper. The runner lies horizontally below one of the blades, opening on the bottom of the boss, while allowing ample room for the core-print; its vertical portion is built up outside the

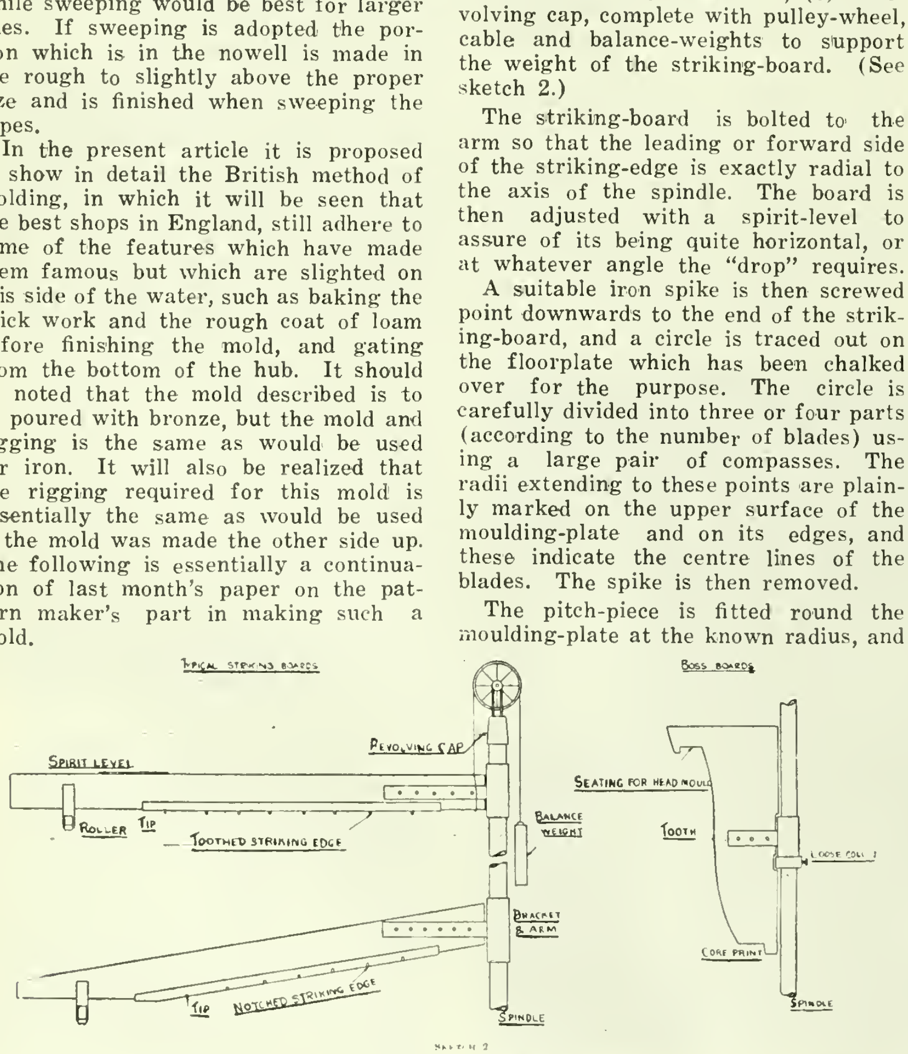


Plate 2. Sweeps for blades and hub

mould, and it is provided with a suitable dirt-trap.

The mould of the boss is roughly shaped with a hard wood template.

First Drying

The mould is then removed to a stove or oven, where it remains until sufficiently dry for proceeding with the second course. It is very important to control the temperature of the driving-stoves; if the heat be too fierce the surface of the wet loam hardens rapidly into a crust, which must crack excessively to permit the steam from the moist loam beneath to escape from the mould. The first drying, while it should be thorough, is of less extreme heat than the second or third drying. It is found economical in foundries which contain two or more stoves, to use one of them for moderate drying, and so on.

The blade pattern thus formed by the section-pieces is filled in with bricks and dry sand, slightly rammed and finished off with smoothing-trowels. Sometimes the pattern is lightly brushed with water to harden its surface, and then the whole is freely sprinkled with powdered plumbago or,"parting sand." The latter is ordinary fine moulding-sand from which all the "combined-water" has been removed, hence no addition of moisture can restore its binding powers. It is commonly obtained by removing the open iron castings.

Building The Top-Moulds

The top-moulds consist usually of an iron "grid" or wicker-work, filled with loam, and suitably strengthened with wire; it is finally bricked to meet a top-plate—one for each blade—which is horizontal and so is parallel to the bottom casting plate. It is bolted and clamped to ensure its unbroken removal. With small propellers the top-plates are often not used; the brickwork walls, strengthened by strong iron wire, being considered sufficiently rigid. Grids, however, are not universally used, and the top-mold is often re-inforced with iron rods only. The grid has, none the less, very definite advantages;—it is stronger, it is easily adjusted, and it requires much less thickness of loam, usually about 2 in. only, which facilitates the subsequent drying to a very appreciable extent.

The "grid" consists of a cast-iron binder (Fig. 3.) which fits on a seating on the top surface of the bottom portion of the mould, and is provided with two rings for lifting, and two large lugs on which the top-mould stands when removed for dressing. Cast into the form or binder in line along its inner edge at intervals of about 2 in.: these can be bent to fit the back of the blade pattern; they are crossed, approximately at right-angles, by other rods, and the whole is securely wired, so that the grid is rigid and strong. The cross-irons toward the root of the blade are bent to form a reinforcement for the wall of loam around the boss.

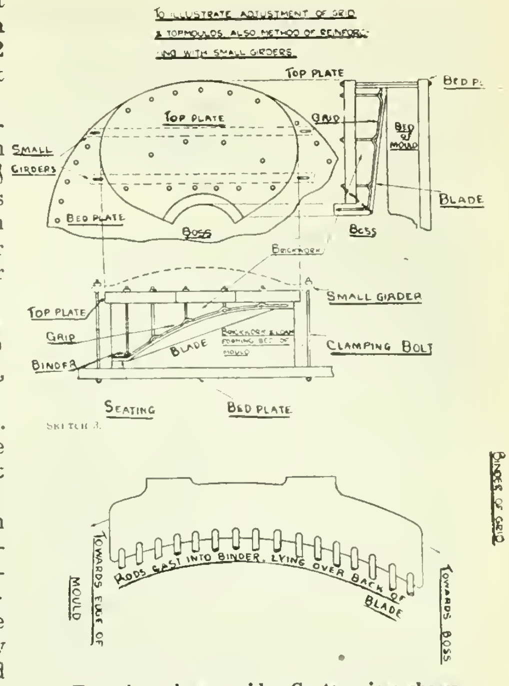
To adjust the grid in position, wooden blocks between ½ in. and ¾ in. in thickness are placed upon the seating and upper edge of the mould. The grid is fitted on these blocks, its irons bent to the required shaps, the cross-irons securely wired and a third ring for lifting fixed to its upper part. The grid together with the blocks, is then removed, a layer of loam is placed over the whole mould area, and the grid replaced in position then covered with a layer of loam, which is smoothed off after the walls supporting the top-plate have been built.

Striking up the Boss

The striking-board for the boss (Fig. 2) is fitted on the spindle as the building of the top-mould proceeds: the clamping-collar is so adjusted that the tooth on the boss-board meets the centrelines of the blade-faces, and the whole of the boss is struck up. After the top-plates have been adjusted, if such be used, and the necessary bolting has taken place, the boss-board and spindle are removed.

Second Drying

The mould should now be stoved for, roughly, thirty-six hours, covering two nights.



Top view shows grid. Center view shows cope clamped down with cover plate. Bottom shows binder rods

After the mould is withdrawn from the stove, the interior of the boss is chipped out along the lines where parting will take place; this facilitates the clean removal of the top-moulds.

It is of great importance that the crane should be capable of very delicate handling, and that the operator should exercise much care in lifting and replacing the top-moulds; otherwise considerable damage from shock and consequent cracking may be sustained by the mould. After parting the mould, the top-plates are supported on the ground in an almost vertical position, and rest on the before-mentioned lugs of the grids.

The brick and loam pattern and the section-pieces are now removed with as little damage as possible to the faces of the mould; the surfaces of the mould are then made good wherever necessary.

The fillet curves are cut away to template and the curved surface rubbed smooth. The faces of the mould are likewise smoother, the blade edges are trimmed and finished, and all unevenness of surface, due to any patching, etc., is removed. The openings of the test-bar recesses are similarly trimmed. The boss is also rubbed down and finished.

All the interior surfaces of the mould are now "washed" and finally dressed.

Third Drying

The tops are replaced upon the mould, but are kept from contact by bricks placed on the seating and edges; thus during drying, the hot air of the stove will be able to gain easy access to all parts of the mould. Care shou'd be tak- will be able to gain easy access to all en when moving finished moulds in and out of the stoves to avoid shocks, such as might occur through uneven floors or rough handling, as any carelessness may result in serious cracking of the mould. The mould is withdrawn after one night

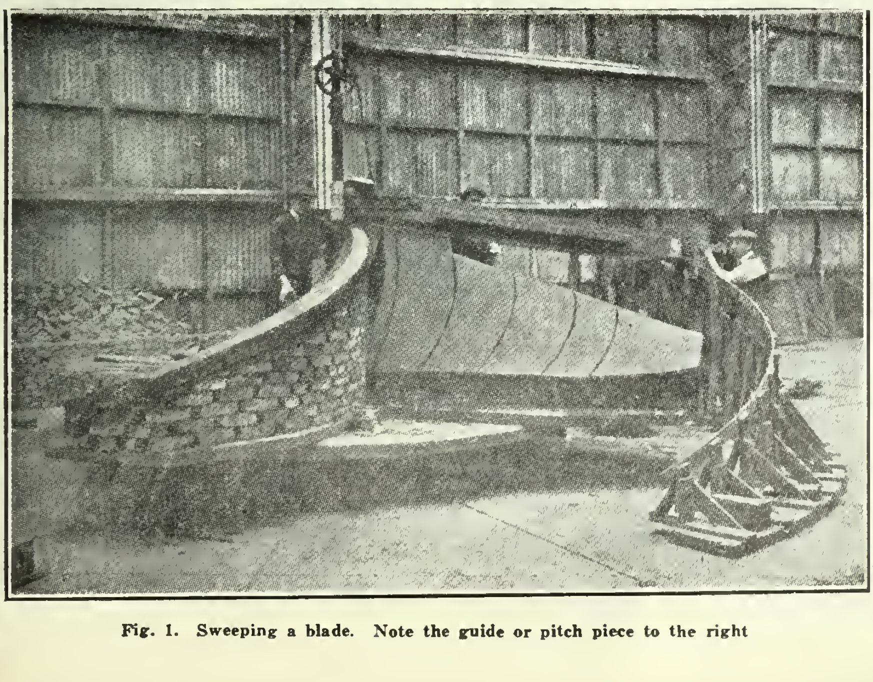


Fig. 1. Sweeping a blade. Note the guide or pitch piece to the right

in the stove. The top-moulds are lifted off and the mould thoroughly brushed to remove any dirt or sublimate; any remaining dust is removed by compressed air. The tops are now replaced with great care, their edges being adjusted by means of marks previously made. The joints to the bed should be made up with loam.

The assembled mould must be firmly clamped to preclude any possibility of bursting or slipping. If top-plates are used, these are secured to the bottom casting-plate by long bolts; and suitable girders are placed across each blade and bolted to the bed-plate also. (Fig. 3). If, as in the case of smaller propellers, no top-plates are used, the girders alone are considered to give ample resistance to the bursting force exerted by the molten metal. The mould must be secured against collapsing and slipping—that is, against the tendency of the top-mould to move down the bed; this is obviated by fixing metal bars vertically between the plates, wedged to the required distance and wired to the clamping-bolts. When the mould is placed in the casting-pit, the vertical portion of the runner should be built up securely, and the whole mould surrounded by rammed sand and interlocking plates, if available. The sand should be very tightly rammed at all joins where the tops meet the bed; this prevents any escape of metal. Around the boss all joins are carefully filled with loam and dressed. The head-mould is now placed in position; it consists of a wide collar of brick-work held between two rim-plates, from 10 in. to 30 in. in depth, according to the size of the propeller. It should be the same diameter as the top of the boss, and be placed concentrically. The join of the boss and head must be finished with loam, and carefully dressed.

Final Drying

To ensure complete dryness of the mould, particularly where the loam has been recently added, local drying must be resorted to. Red-hot weights of cast-iron are suspended from a bar placed across the mouth of the head. The mouth is then covered with a piece of sacking to enclose the hot air. Fresh weights should be added as necessary, so that the mould shall be as warm as possible at the time of casting.

After the final drying of a mould for a propeller of large size, a core is fixed into position. The core consists usually of a "core-barrel"—i.e., a long perforated iron tube—surrounded by a spirally wound straw-rope, which itself in turn is entirely enclosed in specially prepared loam. The core tapers from bottom to top, and it may carry any specified modifications such as the cores of "Lightening-chambers." The core thus struck up is washed and dressed in all respects similar to the mould itself. It must be fixed absolutely concentric with the boss form.

The vertical portion of the runner is now completed with specially prepared hollow cylinders of loam. This is built up securely to a height just above the overflow level of the head. The "runner-box," which will be described later, is fitted and secured; it is of special importance that the runner be thoroughly dry throughout its whole length. Care must be taken to guard against any escape of metal at the joints in the runner, and between the runner-box and the runner.

Provision must be made for a "flow-off" from the head. A channel should be constructed leading into a pig-bed of suitable size, in order that the surplus metal may be recovered in a form convenient for recharging into the furnace.

Moulding a Loose Blade

The procedure followed in making up a mould for a loose blade follows closely on the lines adopted for that of a solid propeller. In the case of a blade, however, a rectangular iron plate is substituted for the circular casting-plate upon which the mould is constructed, and in lieu of a spindle mounted in the centre of the plate, a permanent spindle supported by brackets is let into the foundry floor. This spindle is furnished in the same manner as that previously described for use in molding a solid propeller, and carries the striking board, etc.

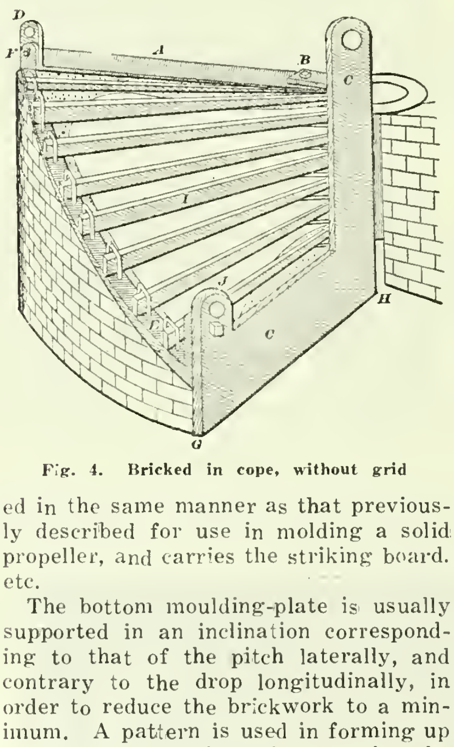


Fig. 4. Bricked in cope, without grid

The bottom moulding-plate is usually supported in an inclination corresponding to that of the pitch laterally, and contrary to the drop longitudinally, in order to reduce the brickwork to a minimum. A pattern is used in forming up the flange, and with this exception the notes already given respecting the preparation of a mould for a solid propeller, refer also, in general, to the whole of the operation required to prepare a mould for a loose blade.

Alternative Method of Making Cope

The illustration (Fig. 4) shows a different but quite common way to construct the cope. A. is a plate 7 inches wide, 1½ inches thick, with hole B cast to secure to plate C and B, a lug being cast at the other end at D, with hole to secure to plate E at F. Plate C, as will be seen, stands on bearings at G. and H, and has bars cast on projecting towards the face of blade, on which to rest and secure other bars, which reach from plate E to centre. This plate stands perpendicular, and the bars must be cast on it to suit the forms of blade, and also to clear the hub, taking care that the top lug comes correct at B. Plate E, as will be seen, has staples cast in it through which the bars are put to carry the face-mould.

When the frame is firmly bolted together—on the joint, so as to secure the proper fit—it must be lifted away and clay-washed. Clean the mould, and oil and parting-sand the face; spread on the loam, and bed down the iron. The bars must now be put in and wedged in the staple, securing the ends at the hub with clamps or wire, as is most convenient.

All that remains to be done now is to fill in the spaces between the bars with bricks on end, packing them in tight with loam, and being careful not to press the ends of the bricks into the face of the mould.

If the iron C is carefully made to fit the hub, there is little to do but fill up the spaces with brick and loam; but, as is often the case, the same iron must be used for a wheel of another pitch. Then irons must be used to bind the face of the mould to the frame. The copes being all marked, as soon as they are hard enough, can be lifted away. Set them down at A and H, and tilt back far enough to finish.

About three or four inches of bearing must be made all around top of hub, on which covering-plate will rest, and provision for running and feeding must be made in this plate, the risers being taken off at the highest point of each blade. It will depend on the facilities you may have for drying and lifting your mould how you will now proceed. Should your oven be too small for the large plate, you can place a sheet-iron curb around and build fires between the piers, covering the whole with plates. Another plan is to strike a bearing outside and around the seating at the hub, on which to rest separate plates to carry each blade. By this means both top and bottom of blades can be dried in the oven and set back to stakes or marks, after they are dry. In very large wheels this must be done. In closing your mould, care must be taken to keep the foundation true to the position in which it was built, as if there should be any warping the wheel would be untrue.

The cross and slings can be used to bind down with, taking care to carry a packing from bottom lug of plate C at J. Plates may be bedded over the blades and wedged under the cross. Care must be taken whilst ramming over the blades to not damage the design of the blade.

This latter method is the one adopted by Simpson Bolland in his book, while the former is from Wesley J. Lambert of Messrs. J. Stone & Co., Deptford, England.

In our next paper we will describe and illustrate the melting and pouring of the manganese-bronze from which these propellors are made.

The Bottom or Center-Blast Cupola Tuyere

Advantages and Disadvantages Compared With Side-Blast—Bad Features Easily Overcome and Much Good Might Come From Further Experimenting if the Idea Becomes Popular

By GEO. O. VAIR

I HAVE IN mind some experiments which I once tried with the centre-blast tuyere and which I am sure will be of interest to readers of Canadian Foundryman.

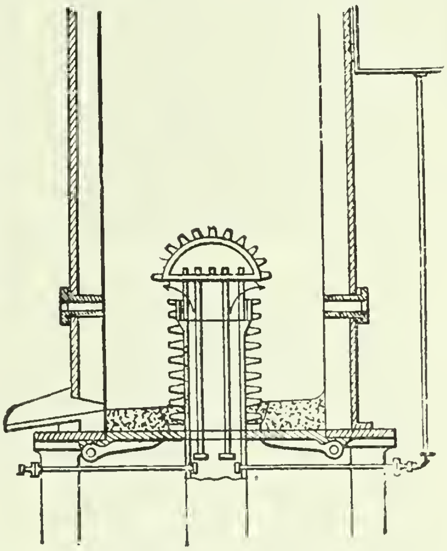
One of the first acquaintances which I made after leaving my home in Canada and seeking my fortune in the United States, was that of the late Thomas D. West, who was at that time operating a foundry in Cleveland, and it was to this shop that I went to work. He took a great interest in me as he realized that I was young and ambitious, and he spared no pains to put me on the right track.

He was an enthusiast on the centre-blast tuyere, and showed me all his drawings and the results of his experiments and when I left to take charge of a foundry he urged me to try my luck with his favorite tuyere. I did, and was more than pleased with the results in some respects, but not so well in others. I improvised a make shift tuyere and tried it several times. The brick lining was as clean after dropping the bottom as before lighting the fire, and everything about the whole heat was first class only that the centre tuyere itself would shell off, and sometimes become bunged. Before detailing my experiences, I should have described the arrangement.

In the illustration is seen the complete tuyere as Mr. West had it. As will be observed it passes up through the bottom of the cupola instead of through the sides, and admits the blast to the centre of the cupola at the same level as the side tuyeres. It is not designed to change the nature of the iron by forcing the blast through the molten iron in the bottom of the cupola in an attempt to bessemerize it, or anything of that kind, in fact, the blast has no more effect upon the quality of the iron when admitted in this way, than when admitted through the side tuyeres.

A tuyere when placed in the bottom of a cupola, unlike a side tuyere, is brought in direct contact with heated fuel and melted iron and it must be made of a heat-resisting material, or protected by some such material if made of iron.

The tuyere shown in the illustration is made of cast iron and is provided with water space between the outside and the inside, through which a stream of water constantly flows when the tuyere is in use, from a small pipe connected with a tank placed alongside the cupola or on the scaffold. It has not been found necessary to keep the tuyere cool with water in short heats, for the heat in a cupola under the tuyere is not sufficiently intense to melt cast iron, and the tuyere may be sufficiently protected against molten iron dropping upon it or coming in contact with it by having a thick daubing of refractory material held in place by the prickers cast on the tuyere. The mouth of the tuyere must be covered to prevent melted iron, slag and fuel from dropping into it in their descent to the bottom of the cupola. This is done with a rounded cap placed on top of the tuyere to throw off the melted iron and slag, and the blast is admitted to the cupola through an opening around the tuyere under the cap, as indicated by the arrows. This tuyere, it must be understood is movable, so that the workman can get inside of the cupola to pick it out and daub the lining,



Center-blast cupola tuyere

and each time it is used it must be carefully daubed and dried the same as is done with the ladles before being put in place again. If the cupola is large enough to admit a man between the tuyere and the lining of the cupola this will not be necessary.

In my experiments I did not use the side tuyeres at all, depending entirely on the centre one, and as I have already said the brick walls had no slag sticking to them and they showed no signs of being burned, but the tuyere would be covered with slag and iron to such an extent that on some occasions it prevented the bottom from properly dropping out. I did not carry my experiments far enough to convince myself that the centre tuyere was a success as I was not in my own shop, but I have thought since that it is worth looking into. There are so many improved refractories now, to what there were formerly, that I see no reason why the upright part, instead of being daubed, could not be made of refractory material. The foundry could be provided with molds in which to make the two parts of the tuyere, or they could arrange to have them made at some place where this was the regular line of work. For comparatively small sizes of cupola, the centre blast could be used by itself while in large sizes the outside tuyeres would be the auxiliaries. The centre blast would certainly be a great saving in linings, as it is the blast, more than the fire, that wears out the bricks. The wind pipe should be under the floor and come straight up under the centre of the cupola, and extend to near the top of where the sand bottom would be. Here the tuyere would begin. The bottom would have to be two doors hinged at opposite sides and notched so as to fit around the upright pipe and fall in both directions when dropped. A certain amount of care would be reqired to prevent the iron from leaking around the upright pipe. If the doors do not fit properly, small plates could be made to the exact fit and rammed into the bottom. It is not at all likely that any saving in fuel would be effected by the use of the centre blast, but there are two features which must be conceded as advantages—it could be made to supply air to the centre of the fire when the diameter of the cupola is too great for the air from the side tuyeres to reach, and secondly it could be used in small cupolas without any side tuyeres, and be a great saving on the fire-brick lining of the cupola. The blast invariably goes up the brick lining in preference to anywhere else and cuts it away. The tuyere as shown in the illustration has all the advantages of a fire brick one, provided it is covered with proper material and properly burned. This is not an expensive line of experimenting and might be the means of bringing out some valuable accomplishments.

FLUMDUM

(Continued from page 19)

fectly perpendicular or at right angles with the horizon. This word "plumb" has now become a part of the language and its etymology practically forgotten. It has become so common that any kind of a weight attached to a string is known as a plumb-bob, and any thing which is perfectly perpendicular is known as "plumb."

Graphite which is frequently known by the misnomer "black lead" is equally as misnamed when it is termed "plumbago" because in this it derives its first syllable from the Latin name for lead in which family it was erroneously supposed to belong.

Research Work on Zinc and Zinc Alloys

Alloys With A High Percentage Of Zinc Replace Brass With Favorable Results—Pressed Zinc A Commercial Success, After Initial Difficulties Have Been Overcome

By WALLACE DENT WILLIAMS

In translating this paper from the German, it was the intention to have all the weights and measurements converted into pounds and inches so that it could be more readily understood by Canadians. This has been found to be a difficult proposition and if successfully accomplished, would tend to detract from the value of the article rather than improve it. It has, therefore, been considered more advisable to give the reader who does not understand the metric system an insight to it so that he can figure it out for himself.

In the metric system of measurements the metre is 39.37 inches and is written m. A centimeter is one one-hundredth of a metre and is written cm. A millimetre is one one-thousandth of a metre and is written mm. Reversing this we have the table—Ten millimetres = one centimetre. Ten centimetres = one decimetre. Ten decimetres = one metre. The decimetre is seldom used.

In weight the basis is the gram, written g. There is also a table of weights in which mili, centi, deci, etc., are used, but these are generally overlooked. The only one in general use besides the gram is the kilogram, which is equal to one-thousand grams. A gram is equivalent to .035 ounces which is too small a weight to be useful in general practice, so the kilogram which is equal to 2.205 pounds, is most commonly used.—Editor.

IN THE experiments carried out with the ruptured bars which were taken from the pressed metal in various directions, Table 3 shows a falling off of the elongation up to a few per cent. which appears, in many cases to be due to bad press-moulding, that causes splitting fissures and peeling of the surface.

Fig. 1 shows an improperly pressed casting, by which the tenacity directly required of tapped threads is reduced by the flow direction of the metal. Figs. 2 and 3 show shapes of castings that have proved to be good.

A remarkable phenomenon is alteration of the properties of pressed zinc under the influence of temperature to which it may be submitted; the tensile properties, as Fig. 4 shows, are dependent to a great extent upon the temperature; the resistance to rupture falls with increasing temperature quite constantly, so that, for example, at about 125 deg. C, it amounts to only about half what it is at 20 deg. C; on the other hand the elongation rises from 0 deg. to 180 deg. C; with decreasing temperature, however, it falls from 0 deg, quickly; at -20 deg. it amounts to only 1/3rd of the value at 20 deg.; the sectional area falls likewise from 0 deg. with decreasing temperatures rapidly, also with the temperature rising to 40 deg. it falls.. The shock test on a notched bar falls as Fig. 5 shows with decreasing temperature; at -20 deg. it amounts to only 60 per cent. of the value at +20 deg. The good properties of pressed zinc are of importance therefore only within a limited range of temperatures, perhaps between 0 deg. and 50 deg., so that as a substitute metal it is constrained to a certain confinement. By repeated tests of stored pressed zinc it was found that after a period of six months (over the winter) no observable influence upon the tensile or impact properties could be detected. The castings lay in an unheated storehouse. As science has demonstrated, the explanation for this behaviour of zinc, lies in the metamorphosis of the interior structure, which is distinguishable by its alterations; then at a temperature of about 180 deg. C, the fine structure disappears and a crystalline granular structure is revealed, with which is also combined a corresponding lowering of the tenacity.

Pressed zinc upon light lathes, without lubrication, may be worked at the highest cutting speed, but in turning fine threads oiling is necessary. The tools and contrivances for light shavings must be arranged for, because the shavings curl up and cling together.

Zinc Alloy

At the close of 1914 the meager copper supply caused difficulties, the further use of brass was forbidden and the resort to substitute metals was recommended. The experiments with pressed zinc had as yet shown no favorable results, and the manufacture of useful pressed zinc articles, under the present circumstances appeared to be still remote. The employment of the alloys then was therefore not to be evaded. The industry was committed to the useful alloys without choice of economical constitutents except that the tenacity had to be specified. The consequence of this was that the industry selected the substitute alloys that were the most easily cast and worked. Then zinc alloys of the following compositions were permitted:

2 per cent. Silicon, plus 1 per cent. lead, balance zinc.

0.5 per cent. Silicon, plus 1.5 per cent Copper, plus 1 per cent. lead, balance zinc.

4 per cent. Aluminum, balance zinc.

The results were manifest soon in the shooting tests. The metal ruptured in the gun-barrels and at the same time frequently caused detonations in the bores (of the guns).

After the author had joined the military service in March, 1915, his first experiment was in the stamping out of these fuses, they showed the same insufficient tenacity. The attempt to make substitute metals was again instituted and experiments with various promising alloys were begun by testing their physical properties in the physical laboratories and afterwards by shooting tests at the military grounds.

With the Austrian army at that time a zinc alloy had been introduced as a substitute for brass. It consisted of zinc with 6 per cent. copper, and 5 per cent. Aluminum. Immediately after it was made known an examination was

Table 3.
Tenacity of Bars from three pressed bars of Pressed Zinc, of various shapes.

Form of Tested body; Place from which the bar was taken.		Resistance to rupture Kg. per Sq. mm.	Elongation %
Form I with much surplus (well rounded off.	Bar 1 from center axis	19.3	13.4
	Bar 2 side parallel to axis	19.3	5.6
	Bar 3 side oblique to the body	17.8	3.4
	Bar 4 transverse across the body	16.3	4.6
Form II with less surplus (Fibers less extended)	Bar 1 as above.	23.4	16.0
	Bar 2 " "	21.4	11.0
	Bar 3 " "	7.6	--
	Bar 4 " "	18.3	4.6
Form III with less surplus (Fibers very much extended)	Bar1 as above	23.4	8.0
	Bar 2 " "	22.9	7.8
	Bar 3 " "	17.8	--
	Bar 4 " "	17.8	1.8

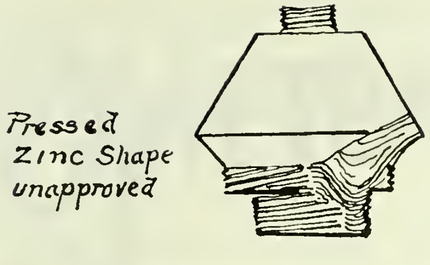


Fig. 1

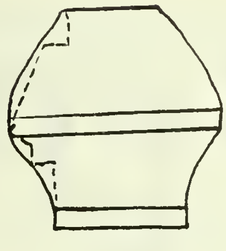


Fig. 2

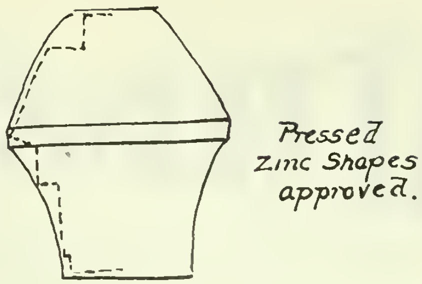


Fig. 3

begun that showed the superiority of this alloy and after fixing the lower limits of the metals that were hard to get, the alloy finally became: zinc, with 4 to 6 per cent. Copper, and 2 to 3-1/2 per cent. aluminum, for a certain kind of fuse. In the Empire the alloy has generally become known under the names of "Austrian" or "Spandauer Zinc Alloy." It has proved to be very good within its stipulated tensile limits and also in the manufactured material. Naturally it is perceived that it cannot be used as a complete substitute for brass, because the rupture tests on bars

From the first, it was foreseen that in order to limit the errors of manufacture, the separate zinc foundries were to be furnished with a greater number of tests, associated with permissible methods of testing and their running operations were to be supervised. From the foundries among which, according to the situation of their connections, there must also be permitted many operations of inferior grade as to supply, in times of peace they had made only inferior lamps and similar objects that were cast from substitute bronze, by the drop-bottom (or bottom-end) pouring

between the gate-head of the molten casting, which should be the last to freeze; therefore it was required along with the use of sufficiently large sectional areas, in this place also the heat was to be confined as much as possible. Whilst many founders had sought to reach this goal by resorting to thick-walled moulds and by other means of super-heating the pouring head to keep it from cooling too suddenly. In the simplest way this purpose was accomplished by keeping the mould walls thin, by insulation with methods of heat

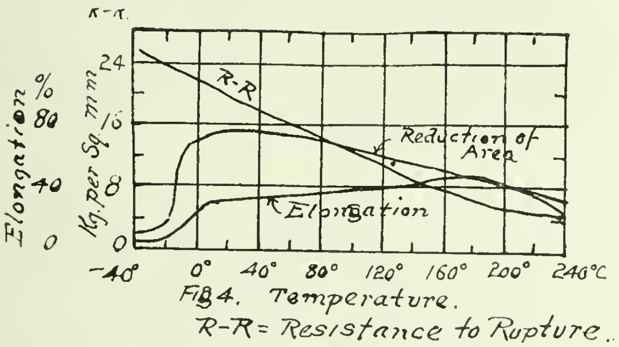


Fig. 4.—Dependence of the tenacity, elongation and reduction of area of pressed zinc upon the temperature.

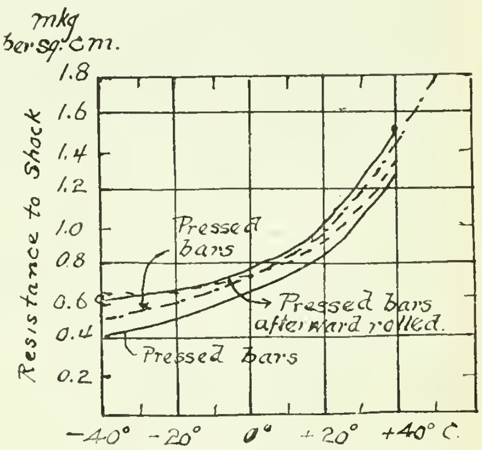


Fig. 5.—Dependence of the impact tenacity of the pressed zinc of various manufacturers upon the temperature

of 6 to 10 mm diam. cut from the raw castings amounted to 9 to 14 Kg per sq. mm, or 12,801 to 19,913 lbs. per sq. in., according to the rate of cooling and the grain-size. The elongation was almost zero, as it corresponded to the very coarse crystalline cast structure. With cast brass comparative experiments gave a tenacity of about 12 to 15 Kg per sq. mm, or 17,068 to 21,335 lbs. per sq. in.; elongation 0.5 to 2 per cent.; in a consolidated condition, naturally more important it went up to 25 Kg per sq. mm, or 35,559 lbs. per sq. in., and an elongation of 15 per cent.

method of casting, for which a special casting, mold was used. From this method of pouring and casting the firms concerned in this new work were not easily dissuaded. It turned out however here also that the old moulds were to be adjusted to the new purpose. It must be cast with a large gate or sink head (waste or lost head, as it is sometimes called), which is supplied at the thick end of the fuse-body. In the trade, in many of the foundries it is pointed out as the small tap-metal made use of by the old foundries. The chief condition for a sound casting is the combination

protection, and by the simplest manipulation to pour them without a waste-head. Such a mould, which was very widely distributed, is shown in Fig. 6; a pouring mould, originated later, is shown in Figs. 7 and 8.

With the casting methods were specified, as well, the temperatures both of the fusion and that of the casting mould. For the first measurement was used an electrical pyrometer, for the latter a

(Continued on page 30)

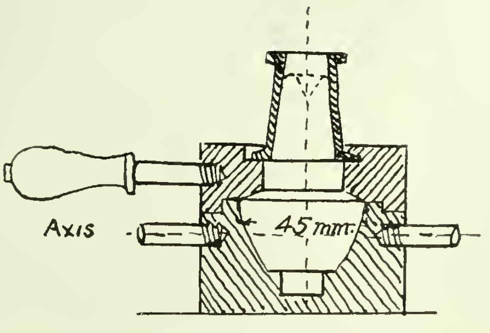


Fig. 6

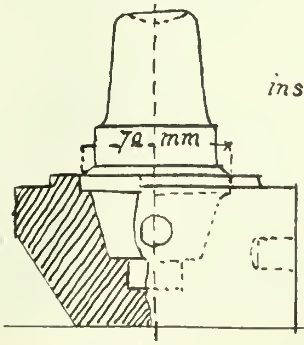


Fig. 7

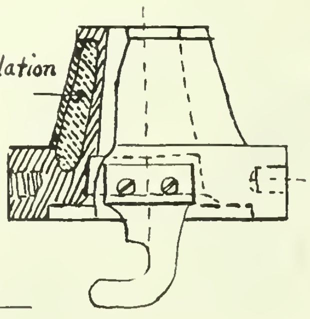


Fig. 8

PATTERNS AND CASTINGS

By W. P. ESSEX

The Patternmakers' Work Bench, And Some Accessories

AMONG THE many necessary tools and appliances that must be provided for patternmakers convenience, the first and perhaps the most important requisite, is a good work bench. Many times has the writer received his first discouraging jolt and disappointment with the shop into which he had strayed, on being shown to a rickety looking contraption supported by two legs in front with the back nailed to the wall and with the introduction "This will be your bench," all hope of being able to make a favorable first impression seemed to vanish as a general survey was made of the dilapidated creaky wooden stand which the foreman had been pleased to designate a bench. The legs and side leaning at an angle far from a plumb line, with the vice jaws below the bench top, and a broken useless stop, the boards of the top warped and split, and shrunk apart with openings between them wide enough for many of the tools to slip through. The top board at the working side of the bench, which some former workman had put over the old top, so humped and irregular, that no part of it could be used on which to dress true a piece of work, and plugged so full of nails, brads, and other abominations, that no mechanic having proper consideration and respect for his tools, would dare to put a plane on, even if he did have the notion that it should be dressed off. It is not fair of an employer to expect a man to give the best results in quality of work or production, if the proper working conveniences are not provided for him, and the work bench should be given as much consideration as any other tool in the shop. Neither is it fair of the workman to abuse a bench because it is shop made, and of wood construction. Some workmen are extremely careless of their benches using their surface to pare on with the gouge or chisel, or sawing light material on, boring work placed directly on the bench surface and permitting the bit to break through the piece, and tear up the top. The driving of nails, brads, and dogs into the bench to hold the work is also a practice to be condemned, and an abuse that should not be tolerated, as it will soon spoil any bench. When paring or boring on the bench top a piece of board should always be placed under the work, to protect the surface of the bench, and the bench saddle shown in Fig. 10, used when sawing of small materials on the top is necessary. For holding work down to the bench top a bench knife is preferable, if a clamp or screw cannot conveniently be employed.

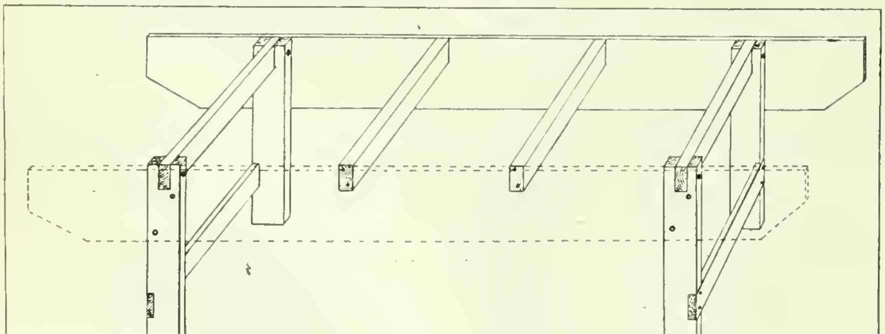


Fig A

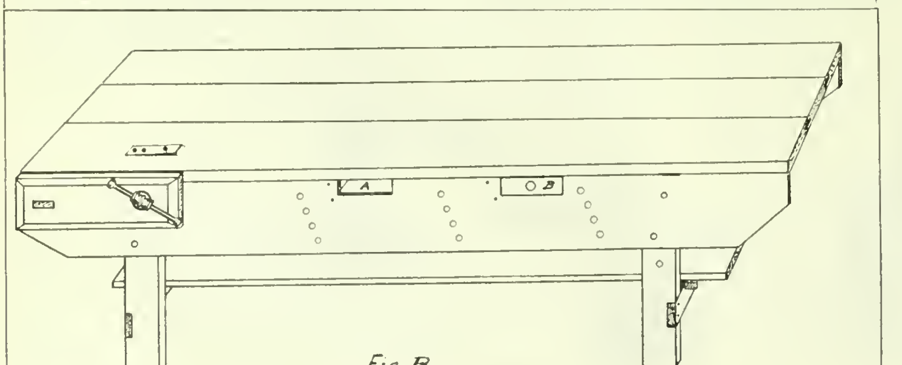


Fig. B

It sometimes happens that a man will find himself on a job where no bench is available to work on, and it is necessary that he construct one. The writer in his experiences has always considered it a most fortunate circumstance to find this condition existing, as he was then assured of a fairly respectable bench on which to work.

When extra work, or a job of unusual size and importance necessitates the putting on of additional help, beyond the existing bench accommodation of the shop, it would be advisable when building new benches to make them in such a way that they can easily be knocked down and stowed away when the work assumes normal conditions again. Unused benches, if not encroaching on useful floor space, soon become cluttered up with odds and ends of materials, and present a generally unsightly appearance.

A very satisfactory working bench can be made in a few hours, if the necessary lumber is at hand. A convenient size not too large with a top about 34 inches wide, and 10 feet long, is about right. Seldom is a larger bench than this necessary for the patternmaker. The materials and method of constructing a bench as suggested, is shown in Fig. A. This will require 4 standards 2 by 5 inches, by the height necessary for the legs, 4 pieces 2 by 4 by 32 inches for the top supports, a slot is cut at top of legs to receive 2 of these cross pieces, and a ⅜ or 7-16 inch bolt is put through leg and support, to hold in position. A piece of 1 by 4 by 32 inches framed across the standards 6 inches from the bottom completes the legs. The side boards should be screwed to ends of top supports in standards, and bolted through side boards and legs, and the 2 middle supports put in. The frame is now ready to screw on the top, which should preferably be made of 2 inch boards dressed true, jointed, and tongued. By removing the bolts from side boards, and those through the legs and cross pieces, the bench can easily be taken down when no longer required, and stowed away. As regards the most suitable wood for making a work bench, hardwood for the legs is recommended, and for the front top board, maple or birch, but both of these woods are liable to warp and wind unless thoroughly seasoned and laid up in strips. If a patternmaker's vice of the universal type is to be attached to the bench, the front top board should be of 2½ or 2¾ inch thickness, and cut away at the end to receive the back jaw of vice which

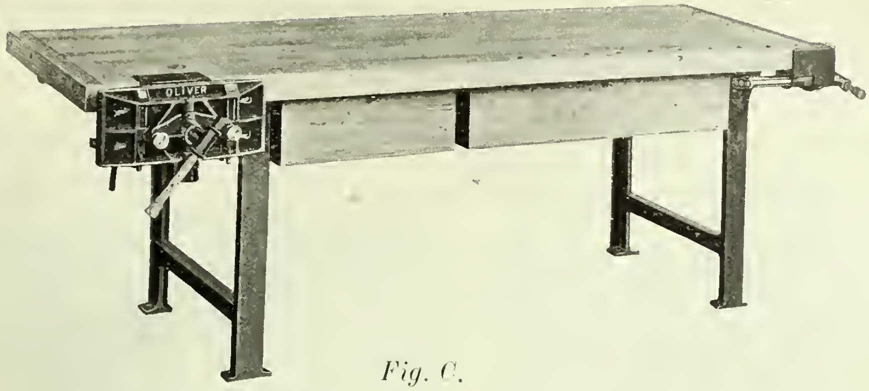


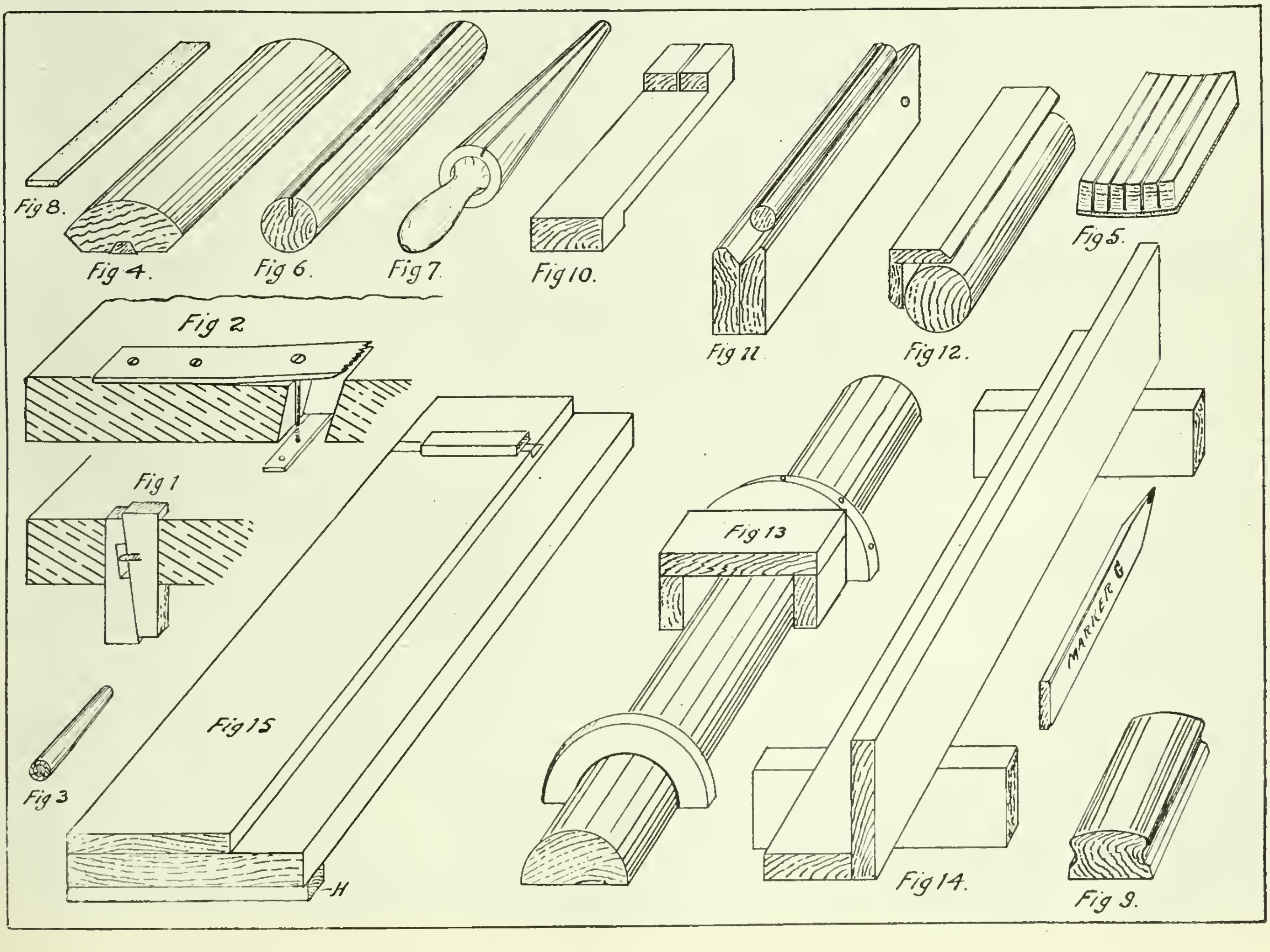
Fig. C.

should be flush with side board of bench this side board cannot extend beyond the leg at the vice end of the bench. A couple of boards held together with two cleats at each end, and fitted between legs and over lower cross pieces, will give greater rigidity to the bench, and also provide a handy shelf. A piece cut out of the side board about 2½ by 10 inches as shown at A Fig. B, is a convenience to accommodate a hand screw or clamp for holding work on the bench top. B. Fig. B is a small drawer with compartments for brads and screws.

Accessions to the Work Bench

The most important of these is the vice, in fact we cannot rightly designate it a working bench until this necessary adjunct is attached. In Fig. B, a wood vice is shown which is placed horizontally with the bench, instead of in the vertical position, which is a more familiar arrangement of the wood bench vice, the position shown is by far the most convenient, especially when a sliding bar with a ratchet it attached at the end of the vice jaw instead of the usual wood bar at the foot of the vice, with holes for a pin or spike to make the adjustment. The wood vice however is suggested only in an emergency, or when a proper patternmaker's vice is not obtainable as there can be no question as to the best type of vice to use. By all means secure a universal patternmaker's vice as shown on the bench in Fig. C if possible. The Emmest's patent universal wood worker's vice, has proved to be a most valuable acquisition to the pattern bench as it is adaptable to holding ary piece of work, no matter what the shape, and is adjustable to any angle or position that may be required for convenience of working.

Such a small affair as the bench stop is worth a little consideration, for there are few annoyances more trying to one's patience when planing a rather short piece of material, than a bench stop that does not hold. Experience with the old double wedge type of stop Fig. 1, that works up or down in a mortise in bench top, might be fairly satisfactory for a carpenter's work bench, but not for the patternmaker's. It is not easy of adjustment, and when the corners become rounded thin work will ride over the top. A far more satisfactory working stop may be made with a piece of flat steel or iron ⅛ inch thick, 1½ inches wide by about 9 inches long beveled at one end like a chisel in which a few teeth are filed on the beveled side, this should be bent up for 6 inches at an angle of about 3 degress, two countersunk holes are necessary at the flat end, to screw stop to bench which should be sunk in flush with the top, and a third hole for a ¼ inch flat head stove bolt, with a piece of ¼ inch flat iron tapped for the stove bolt, and screwed to the under side of the bench, this screw with the spring of the bent part of the stop pro-



vides with the assistance of a screw driver, means of adjusting the stop, which is shown in Fig. 2. There are a larger number of mechanical bench stops on the market, some of them are really effective stops, and much to be preferred to any of the home made varieties. One operating from the side of the bench is most convenient.

The bench pin Fig. 3, is a handy little article for which provision is seldom made in a patternmaker's bench sometimes this little peg will be found very useful providing a convenient means for supporting work that extends some distance from the vice. The holes for the bench pin should be made in rows about 2 feet apart, and about 2½ inches apart in the rows, and bored at a downward angle of about 15 degrees. The pin is best made of soft wood turned slightly tapering and smooth.

An attractive type of work bench specially designed for, and well adapted for pattern shop service, was placed on the market some time ago by a well known manufacturer of wood working machinery, and is shown in Fig. C. The top is 2⅝ inch thick, 30 inches wide by 8 feet long, made of hard maple, air seasoned and kiln dried, laid up in strips which are double doweled and glued, with grooved bolsters bolted to the tenoned ends of top, and supported on substantial cast iron legs. In the front top board are ten square mortises, a very convenient arrangement. The bench is provided with two drawers, and fitted with a No. 1 Universal pattern maker's vice, a 4 by 6 inch adjustable jaw, tail vice, and adjustable bench stop. There are many features about this bench that commend it to particular and exacting craftsmen.

Some Other Useful Acessories

There are quite a number of old, and more or less well known shop made articles that should have a place around every bench, and which as they are easily made and extremely handy at times, are worthy of a brief review. There are perhaps more modern devices that replace some of them, but if these simple contrivances are made and kept in a convenient place, ready at hand, there will be found frequent use for some of them throughout the day; not only in the small shop, but also in the shop equipped with modern tools and appliances.

The devices for holding sand paper, and sand papering, of which there are a wide variety, are very useful, and an assortment of blocks, strips, and rubbers of different shapers and sizes should be made and kept within convenient reach. For sand papering core boxes and curves of large radius, blocks made like Fig. 4 are useful, or the flexible rubber Fig. 5, that will adapt itself to any large curve is very handy, this is easily made by gluing a piece of leather belting onto a wood block of suitable size and shape and making a number of saw kerfs through the back of the block down to the leather. For small round core boxes and hollows, cylindrical blocks like Fig. 6 will be found more convenient. These should be made of pine ed taper pin with handle Fig. 7 is handy. For finishing small flats or squares, the sand paper file or strip Fig. 8 is most convenient, these should be made of pine about 3-16 inch thick by 1¼ inches wide, and in length the width of the sand paper sheet, with the sand paper glued on each side. A very convenient shape for a flat face sanding block is shown in Fig. 9.

The bench saddle, Fig. 10, is not only useful in protecting the bench top from injury when using a saw on the bench, but provides an effective means of holding the work during the operation.

V blocks of various sizes (Fig. 11) will be found very useful for working out wood fillets, planing angular or irregular shaped strips, making large dowels or planing cylindrical work where turning is impractical. The writer has an interesting recollection of over a years experience with patterns mostly for machine repairs, in a shop that did not even have a wood lathe, and all cylindrical patterns were turned (?) with the plane and the V blocks.

A few carefully made right angle straight edges, or box squares, similar to Fig. 12 will be found exceedingly handy for laying off and marking parallel lines on cylindrical shaped patterns.

The straight edge and parallel blocks shown in Fig. 14 should have a place in every pattern shop. There are times when a workman will be put to considerable trouble in the effort to get a parallel line on an irregular shaped pattern, and then possibly not a true one. With the marker G, and the straight edge on a couple of parallel blocks, as shown, parallel lines may be accurately and quickly struck across any irregular shaped pattern of medium size.

The saddle or box shown in Fig. 13, is a very simple contrivance, and adaptable for a variety of purposes such as setting flanges or collars on cylindrical patterns like pipes. This will be found to be particularly useful in shops where there is considerable changing of these members on patterns, to obtain different lengths of pipes.

The shooting board Fig. 15 is a well-known and easily made contrivance, for planing with or across the grain, work that cannot be conveniently or expeditiously worked in the bench vice, as segments, mitres and bevels on round, half round, or moulding. The shoot board shown is a very simple affair about 2 feet long, a piece of ½ or ⅝ inch board 6 inches wide screwed onto a 1½ inch piece, about 8½ or 9 inches wide, is all there is to it. With the exception of the stop, this may be screwed on, but a better way is to dovetail it in with a slightly tapering tail. The stop H, shown on the bottom of the board, is screwed on as a convenience when using across the bench. This can be removed when using the board longitudinally and against the bench stop. It is surprising how often throughout the day that this simple contrivance will be used, if kept in company with a sharp plane in some convenient position. There are several types of shooting boards adaptable to a wide variety of work, which will be referred to in future papers.

RESEARCH WORK ON ZINC AND ZINC ALLOYS

(Continued from page 27)

mercury thermometer which was stuck through a hole in the mould. The dependence of the density, freedom from piping, grain-size and tenacity upon the temperature was practically tried out by several firms; in general the pouring temperature was kept at from about 45 deg. to 490 deg C, and the chilling temperature was kept at about 170 deg. or 240 deg. C.

Most of the firms organized their foundries so that a series of especially fired melting pots (with iron troughs) were installed. To each melting pot belonged one or more pouring tables each furnished with a series of metal moulds. The zinc alloys were either ordered made by the foundries, or only the preliminary alloying was done for them and then this metal was remelted with zinc. Large foundries also had some crucible furnaces for the production of the preliminary alloys. A series of 10 to 20 moulds were filled at one time from a pouring ladle, according to their capacity (metal stock) and the speed of cooling. Finally most of the foundries worked only with a female personnel; the inspectors were men. The division of work was so arranged that a work-woman with the pouring ladle filled the moulds on a casting table, one after another, a second woman took the chilled castings from the moulds and again put the moulds together. In separate operations a particular work-woman was engaged to supervise the temperature of the casting moulds in every column. According to the number of the casting moulds there followed counterdraws whilst the first lost cooled off, so that a favorable temperature was not required. (In other words the pouring was so continuous that the moulds were kept in the proper temperature for pouring without the necessity of a pre-heating). The first pouring off of a cold casting mould was remelted on account of its danger from piping; from two or three pourings off from a mould were sufficient to give the mould its proper temperature for receiving the casting. In a special section of the foundry band-saws or circular saws were set up, by which the second melting of the gate-heads were rejected; in a special operation the heads were sheared off.

By the settlement and the supervision of the preliminary conditions for the pouring of the rough zinc fuses from the "Spandauer" alloy, this manufactured material proceeded from the greatest complexity to such simplicity and completeness that from all the foundries with only a few exceptions the operations were carried on with the smallest waste and for the makers was very profitable.

Rustless Iron May Become Commercial Success

Sheet and Wire Field May be Revolutionized—Ship, Bridge and Automobile Makers Waiting Developments—Malleability and Pouring Qualities Not Yet Perfected

IN our January number we described some of the potentialities of rustless iron as demonstrated by experiments at the steel mill of Sheffield. In Feb. we published a letter from a foundryman who had made castings from the metal. In the present article we publish the opinion of Dr. Miller Reese Hutchinson, as expressed in an address delivered a few nights ago before the Alumni Association of Cooper Union in New York city.

Chromium is the metal which, when added to iron causes the phenomenon, but this being a comparatively rare metal and somewhat difficult to refine would make the resultant rustless iron expensive. This has been partly overcome by using the chrome ores without refining. The following report is from the New York Herald.—Editor.

Rustless iron, non-corrosive, imperishable steel have been brought at last within the pale of practicable commercial products. In the opinion of Thomas A. Edison, Charles M. Schwab and other manufacturers, metallurgists, inventors and chemists who know of recent developments in this field, the achievement is probably one of the most important in modern metallurgy. In the magnitude of its influence on the metal industries it is likely to be well nigh revolutionary.

The announcement that the long sought goal of rustproof iron and steel had been attained was made last night in an address at Cooper Union before the alumni association of that institution by Dr. Miller Reese Hutchison. Dr. Hutchison is a noted inventor and engineer, though not the author of this particular discovery.

He was for many years Mr. Edison's confidant and chief engineer, was a member of the war time Naval Consulting Board and is the inventor of the Klaxon automobile horn, of devices which have supplanted the old ear trumpet in enabling the deaf to hear and of many other utilities.

Perfected in England

In his Cooper Union address Dr. Hutchison announced the recent discovery of a method of manufacturing material which, when mixed with molten steel or iron, renders it entirely rustproof and to a great extent even acid proof. The speaker gave the principal credit of the discovery to W. B. Ballantine, an English metallurgist, though Mr. Ballantine in his experimental work in certain of the mills of Sheffield, England, has had the co-operation of other experts.

Dr. Hutchison exhibited samples of the base material itself and also specimens of sheet iron, wire cables, cooking utensils and other articles made from this imperishable product. As a result of experiments in England it has been foreseen that rustless iron and steel could be used successfully in the manufacture of cutlery, art metal work, hot water bottles, bath room fittings, bolts and nuts, bicycle parts, cooking utensils, drop forgings, electric fittings, engine fittings, stoves and ranges, steam radiators and railway fittings.

The final phase of the problem, which now appears to have been solved, was to make this material sufficiently ductile to permit of its use on a scale commercially profitable in the rolling of iron and steel plates, structural material, rails, or even wire.

Process of Immense Value

"Since the original discovery and utilization of iron and steel," said Dr. Hutchison, "there has been an unceasing battle between man and the deterioration of iron and steel through oxidation, or 'rusting,' as it commonly is called. Witness the necessity for constant vigilance and repeated paintings of such steel and iron structures as the Brooklyn Bridge, for instance.

"Imagine then the value of a steel or iron possessing all the strength of ordinary steel or iron, but which can be left without attention for generations c time and even in the most humid o climates.

"This wonderful material is known to the metallurgical world as chromium. It is found in crude state in many parts of the world and as chromite ore is reduced in an electric furnace, producing an alloy of iron and chromium, with from 4 to 8 per cent. of carbon in it. This high carbon product has been commercially available for many years and is used in the manufacture of automobile axles, cutlery and other high carbon steel products to which the chromium imparts great toughness.

"The production of rustless sheet iron and wire and of low carbon steel, however, has proven heretofore commercially impracticable because of the until now high cost of removing the carbon from the ferro-chrome of commerce. Unless the carbon is removed or reduced to a very low percentage the addition of the chromium to the molten iron or mild steel carries with it so much carbon that the resultant product is too hard to roll into sheet and to draw into wire to meet a market now dependent on galvanized sheet and wire.

"A large use to which this new material can be put is in the manufacture of a low priced automobile which will not have to be painted. There is no more attractive finish than that of burnished steel, which is imparted to this material by the fabricating methods."

Another claim for this material is that ships with hulls built from it will not have to be docked repeatedly for scraping and cleaning of their bottoms, as marine growths will not adhere to plates rolled from the rustless iron. Neither will it be necessary, Dr. Hutchison declared, to tar the rigging or to paint any part of the ship constructed from this material.

Dr. Hutchison quoted from a letter to him from Charles M. Schwab, head of the Bethlehem Steel Corporation. Mr. Schwab expressed the opinion that if this new product can be supplied in commercial volume to the steel and iron mills so as to enable them to incorporate it in their sheet and wire output there would be a tremendous market for it even though it might have to be sold in competition at a price double that of galvanized sheet and wire.

Dr. Hutchison is the president of Miller Reese Hutchison, Inc., an organization with international ramifications. Its New York office and laboratories include the fifty-first floor of the Woolworth tower.

NEW MOTOR-DRIVEN DISC SANDER

The Oliver Machinery Co., Grand Rapids, Mich., have recently put out a new motor-driven disc sander to be known as No. 182. It sands work up to 15 inches in diameter and duplicating work up to 7 inches wide. It is portable and can be placed near the operator and his work. The disc-head is a one piece iron casting, containing disc, disc shaft, ball bearing end thrust and exhaust

fan and system, forming one complete unit. The table is made of cast iron 9¼ inches wide, 21 inches long and 37 inches high from the floor.

The column is made of cast iron, with wide flange giving solid footing on floor. The angle gauge operates in table slot and is graduated from 0 to 45 degrees both to right and left for accurate setting. The switch is of push button type, placed on column of machine.

Progress in Manufacture of Malleable Iron

Improvements Are Noted But Further Developments Are Predicted—Air Furnace Designs And the Bunsen Burner Are Noteworthy Advances—Continuous Type of Oven Also Discussed

By ENRIQUE TOUXEDA

FEW IF ANY consumers of malleable iron castings deny the fact that within recent years there has been a marked improvement, not only in the physical properties of the produce, but particularly in its uniformity. Assuming this much is conceded, let us analyze briefly the present situation with a view of determining the prospect for a further betterment of process and product, and make inquiry as to how future activities may best be directed to bring about this result.

In the manufacture of malleable iron, the metallurgical apparatus consists of melting furnaces and annealing ovens. These usually were built by men who had but little knowledge of calorics and who were further handicapped by ignorance as to the chemical reactions that were taking place during melting and annealing. Inasmuch as the first reverberatories built were for the manufacture of wrought iron, it was but natural that their design would be closely copied. It is gratifying to note that the camel back and other freak construction inherited from this source has almost entirely disappeared.

Air Furnace Thermal Efficiency

Let us inquire what recent changes in design have accomplished toward the cheapening and betterment of the product. In regard to the former it hardly can be claimed that the air furnace thermal efficiency has been bettered except in a minor degree. Those who are familiar with this furnace must realize that in its present type it is of necessity so very wasteful of heat that without certain modifications to which we shall shortly refer, little more can be done to improve its efficiency. In the best designed air furnaces now in operation this does not exceed 10 per cent. If the British thermal unit value of the coal per pound is 14,000, then 90 per cent of the heat is lost, in part through radiation, but to a much greater extent up the stack. Therefore of the 14,000 British thermal units, only 1,400 are doing useful work.

The foregoing does not mean that no substantial benefit has resulted from the improvements that have been made in air furnace construction because such is not the case. However, these improvements have operated to make for greater certainty in uniformity of the hard iron from heat to heat, rather than in saving in coal. Much progress has been made in this particular and it is certain that this attainment is preeminently of much greater importance than a savng in coal, because of all desiderata uniformity of the product stands first. It can be stated therefore that an improvement in product certainly has resulted from such changes as have been advocated and put into effect in later air furnace designs.

Is there any hope that the efficiency of the air furnace burning coal on a grate can be improved by, say, 50 to 100 per cent, or the control perfected to a point that will facilitate a still greater uniformity of product than is possible in the present day practice?

Proportioning Air Supply

One of the shortcomings of the air furnace is the proportion of the secondary air supply admitted through correctly inclinded tuyeres that protrude through the furnace roof at a short distance in front of the bridge wall, in such amount as will provide for the proper combustion of the volatile combustible of the coal. It is manifest that if there is a certain amount of combustible passing over the bridge at a particular interval of time there should be admitted only the number of pounds of oxygen that will just completely unite with this combustible, no more and no less. If too little air is admitted, combustion will not be complete and fuel will be wasted, while if too much is admitted, the condition will be increasingly bad in proportion to the amount of air in excess of that necessary to secure complete combustion.

In practice the overhead blast delivers a constant quantity of air, and it is clear that when the stoker shovels in coal to renew the fire the volatile combustible comes off with such rapidity that if the air supply is just sufficient to take care of this amount it would be an instant before it would be so greatly in excess of requirments that from this point on the condition would continually grow worse until firing was repeated. An investigation of this matter through CO_2 determinations on various furnaces disclosed the fact that the CO_2 was frequently as low as 9 per cent. when it should have been near to 19 per cent. Consequently, due to these unfortunate conditions, the air supply is adjusted in such a manner, that on firing there is a strong reducing flame and at the time when firing is to be repeated the amount of air is not too greatly in excess. If this indicates anything at all it shows that firing should take place at very short intervals of time when obviously the adjustment of the secondary air supply can be more accurately gaged.

It also indicates that it is highly desirable that mechanical means be devised to deliver a constant small supply of coal to the fire pot, in which event it would be possible to quite closely adjust the air supply in theoretical proportion for combustion. Thus far efforts in this direction have not proved fruitful.

The foregoing state of affairs is exaggerated in those furnaces in which a thin bed of fuel is used, a condition that was general some few years ago, barring a few exceptions. Confronted with these facts the author, in the air furnace designs he has made, always has arranged for a deep bed of fuel in order to convert as much of the fixed carbon on the grates to CO, a combustible gas to the end that this would augment and make more constant the amount of combustible gas passing over the bridge in any interval of time between one firing and the next. This allows not only a more proper adjustment of the secondary air supply, but also makes possible the utilization of considerable of the fixed carbon in the hearth, rather than in the fire pot where it does infinitely less good. An attempt has been made by the author to see if it would not be practical to set up a CO_2 recording instrument close to the furnace, connected by an electrical device with the damper in the overhead blast pipe in such a manner that the damper could be functioned by the movement of the recorder. This proved impractical because of the impossibility of securing a recorder with quick enough action. That is, the results shown on the instrument at any instant corresponded to conditions existing some four minutes previously, which obviously made this attempt at control impractical. The writer believes that there is little hope of improvement in fuel efficiency, unless some one devises a practical mechanical stoker, makes use of powdered coal, or resorts to some of the schemes of which mention will be made. The author does not believe that any attempt yet made to construct a gas producer integral with the furnace has proved a success.

Intermittent Operation is Factor

One reason why gas producers integral with the furnace have not been more generally adopted is the fact that inasmuch as the furnaces are run intermittently, and it is essential that the producer have a very deep bed of fuel, too much unconsumed coal must be left in the fire pot at the end of the heat. Aside from this, steam is not used under the grate and in consequence the gas is very lean. If the furnace were worked continuously the story might be brighter in the case of those furnaces in which this principle has been employed.

Moreover, the designs are faulty, for the producer end of the proposition has been practically such in name only. The author believes that in a properly designed furnace of this type, a fuel ratio equal to or in excess of that at present attained through the use of powdered coal is possible, provided two heats per day are run. While this may seem attractive, it should appeal only to small plants that would not be justified, owing to various circumstances in installing a powdered coal equipment, in spite of the fact that the installation cost would be divided between the annealing ovens and the melting furnaces. It seems more than probable that as soon as certain improvements in the adaption of powdered coal to air furnace work have been made, this fuel will prove most promising for use in this type furnace, due to the high fuel ratio possible, coupled with the attractive features of less manual labor and better combustion control.

In 1906 the writer was granted a basic patent ("Art of Metallurgy No. 823,560") on what he deemed was an improved type of air furnace. from the operation of which it was quite confidently expected a saving in fuel and particularly a more perfect control, could be expected.

Use of Waste Heat Boilers

Waste heat boilers have been used for years in connection with puddling and air furnaces. In such cases, however, the steam has been used in steam engines for the operation of various kinds of machines. When waste heat is utilized in this manner a saving in coal is affected, but while this is true it does not all to the efficiency of the furnace, for the latter is designed to melt iron and not to run machinery. If, however, the steam from the boiler is used in a steam turbine geared to a generator, and the current from the generator run to electrodes that protrude through the sides or roof of the furnace, or into fire-brick electrodes at high temperature, one in contact with the bath at each end of the hearth, then the waste heat can be converted by this means into heat within the furnace, which of course, will increase the furnace efficiency directly as the amount of heat absorbed. Not only would this be accomplished, but much more important still the scheme admits of a much better furnace control than is possible in ordinary air furnace work, as almost any degree of super-heat can be obtained in an extremely short interval of time and at the exact moment it is needed.

In a fair-sized plant where numerous furnaces are running at the same time, steam could be used from the waste heat boiler of one furnace to augment that generated in the particular one from which a heat is about to be tapped, making the scheme elastic and adding to the amount of current possible to obtain in any interval of time. This scheme would operate, or should, to also shorten the heat and make possible the obtaining of a greater number of heats from one furnace.

Some seven years ago the author designed a two-hearth reverberatory furnace, after Pietzke, the substructure of which rested on a standard railway turntable center, in order that it could be made to revolve between a fire pot and stack that were permanently fixed. In operation a charge is placed over the hearths. As the gases pass over the charge in the hearth next to the fire pot, they must of necessity go through the second hearth before they can reach the stack. By the time the charge in the hearth No. 1 is ready to be tapped, it is expected that the charge in hearth No. 2 will have been melted. Instead, however, of tapping the heat that is ready while the furnace is in its original position, it is first revolved, for not only can it be as successfully tapped when next to the stack but this procedure results in allowing the partly finished heat in the other hearth to receive the maximum temperature of the fire pot at the earliest possible moment. A charging platform of proper inclination and height and of a capacity sufficient to hold an entire charge is conveniently located at one side in such a position as to enable the furnace when revolved to register with it. In this manner a charge can be slid into the hearth within a few minutes, this being facilitated through the raising of a hinged section of the roof and the special construction of the platform. The same principle can be utilized in other forms of construction, as the rear hearth can be at a higher level than the one in front of it, and the molten metal which it contains can be allowed to flow by gravity through tap holes connecting the two hearths. This scheme would do away with the necessity of revolving the furnace, but the charging would have to be done in the usual way.

Design of Double-Hearth Furnace

The author also drew up designs for a double-hearth with a common side wall, the fire pot being located between the separate flues of a stack that met in one flue above the fire pot. In this case the furnace would have to rest on a track, in order that the two hearths alternately could register with the fire pot and one leg of the stack, while the other stack leg was closed by a damper.

The writer has thought of one other way in which it might prove practical to make use of the waste heat from the air furnace, which has to do with the reactions that take place between steam and incandescent carbon. In the operation of a gas producer, the amount of steam that is possible to use in order to enrich the gas to the fullest practical extent is limited, for if an attempt is made to use an excess, the fire will be cooled to a point that will prevent the desired reactions from taking place. When dry steam comes in contact with carbon at a red heat, or over the temperature that this signifies, it is decomposed into two combustible gases, viz., carbon by inert nitrogen so that the full caloric value of the gases can be secured. The importance of this will be appreciated when it is stated that the average nitrogen content of producer gas is about 47 per cent.

If therefore, the space between the rear bridge wall and the stack of an air furnace be arranged so that a layer of coke, protected by a thin gas-tight brick covering, can be conveniently inserted and the ash withdrawn, or some other arrangement employed that will perform the same service, steam generated from a waste heat boiler can be passed through the incandescent coke and the gases withdrawn at the other side and led by pipes to the front end of the hearth at each side where they would be consumed. A charge of one ton of coke would be sufficient for quite a number of heats, for the reason that this amount of coke would yield about 120,000 cubic feet of gas having a B.t.u. value of about 617 per cubic foot. Assuming that the coal used in air furnaces runs 13,575 B. t. u's. per pound, one pound of coal will be equivalent to 22 cubic feet of gas, or the 120,000 cubic feet will equal 2.75 tons.

While the efficiency of the open-hearth furnace is practically double that of the air furnace it is questionable if the melting can be done for half the cost if the latter is replaced by the former. Where natural gas or coke oven gas is available this can certainly be approximated, and to a lesser extent with oil, but if a gas producer installation is necessary, the interest on the investment, operation and maintenance, etc., will represent such a substantial figure that the proposition may not look as inviting as it might appear at first sight, particularly as the open-hearth furnace itself costs something over $1,000 per ton of capacity.

It is not believed that any worth while improvements have been made in open hearth furnace construction used in the malleable iron industry. Is there a chance? The author believes this possible. The Blaw-Knox Co., Pittsburgh has control of a device developed by Mr. McKune of the Steel Co. of Canada, the object of which is not only to produce a bunsen burner effect at the port, but it enables the ports to be so adjusted that they can best be proportioned for burning the fuel and allowing the products of combustion easy passage to the stack. The installation of such a device in present furnaces would result in both economy and better control. Both economy and uniformity would result if instead of melting the cold charge in the open-hearth furnace, if it were melted in a cupola adjacent to the furnace and either allowed to run down the spout and into the hearth by gravity, or the molten metal introduced into the hearth by means of a transfer ladle, thereby increasing the furnace capacity, and reducing melting costs, etc. The author has made this suggestion many times in the past, but it does not seem to have been attractive to those whose plants would easily admit of this method of procedure. A melting ratio as high as 10 to 1 could be obtained in the cupola for the reason that the molten metal would not have to be given more superheat than is sufficient to enable it to easily run down the cupola spout or pour from a transfer ladle without serious skull. The sole reason why cupola malleable is not the equal of the air furnace or open-hearth product lies in the fact that inasmuch as it is melted in the presence of carbon, it is unavoidably much too high in that element to produce a superior product. If it were possible to control the carbon content in cupola hard iron, this product would equal that made in any other type of apparatus. There seems to be a fear on the part of many that cupola metal also would be too high in sulphur. It is not difficult to make grey iron castings in which the sulphur does not exceed 0.070 per cent. There are plants where the sulphur content is at times as low as 0.055 per cent. In either the air or open-hearth furnace, a much greater percentage of the silicon, carbon and manganese is oxidized while the charge is being melted than subsequently takes place. In other words, if a normal oxidation of the impurities results during the melting of the charge, there is little liability of trouble from this time to the end of the heat. The author believes that a more uniform melting is possible in the cupola than in the air or open-hearth furnace, for the control is simpler. No trouble is experienced in obtaining a cupola product having a carbon content of 3.00 per cent. and if just previous to the time the molten metal from the cupola product having a carbon content nace, sufficient steel is charged into the hearth to lower the total carbon by a proper amount, no trouble should be experienced in connection with this proposition.

The use of the Stoughton oil-fired cupola would enable both the sulphur and carbon to come under better control and this would be the logical cupola to use. Some plants have as many as six open-hearth furnaces and melt a large daily tonnage.

Use of Coke Oven Gas

Taking into consideration the high cost of fuel oil, the fact that the price of natural gas is constantly soaring, coupled with the cost of installation of producers, etc., it is practical in such plants to lower the fuel cost through the installation of a number of small by-product coke units, provided they are in a locality where the sale of the coke and other by-products is easy. The gas could be used in the open-hearth furnaces and annealing ovens, as well as for running a gas engine to generate electricity for power and light, and if necessary, for heating purposes. Certain companies make a business of selling the various by-products on a commission basis.

Probably the greatest advance toward improvement of product chargeable to change in apparatus has been made in the case of the annealing oven construction and control. In this particular, and this actually is the heart of the process, great strides have been made within the past few years. Not long ago conditions in the annealing department could not well have been worse. This statement is not too sweeping because almost every principle was violated. Those concerns whose ovens were under pyrometric control could be counted on the fingers of one hand; now the number who are not thus equipped, at least among the numerous concerns with whom the writer is acquainted, could be counted in the same manner. An understanding of the reactions that take place during the anneal illustrated the absolute necessity for positive control at temperature as well as during cooling. Four years ago few if any ovens were insulated; to-day practically all new ones are so thoroughly insulated that a person can hold his hand on the outside plates without discomfort. While this obviously makes for fuel economy, the more important matter is uniformity of temperature throughout all parts of the oven. Greater care is being exercised in damper and ash pit door construction and freedom from leakage throughout, in order that the cooling down from temperature can be gaged with nicety.

The sloping roof has made possible the avoidance of excessive heat at the bridge wall, and has resulted in an evening up of the heat at the front end of the oven. The building of the ovens in single units, with the stack or stacks on the inside has not only served to cheapen construction, but obviously has permitted the oven to be brought to temperature more quickly. This also serves to greatly lessen the smoke nuisance. The solid floor has replaced the complicated and costly under-floor flues. It now is the general practice to have but two short underground flues, one at each side of the oven, leading to the stack.

In the author's latest design, in which he has used a gas producer fire-pot integral with the oven, a sloping roof over the oven proper and stacks within the oven, there are no underground flues whatever. The main side flues which carry the products of combustion to the stack are built on top of the oven side walls where they may be easily inspected at any moment.

Opportunities for Young Men

Discussing the problems of plant organization, it can be stated that a betterment of the product, particularly in regard to uniformity, can in part be credited to the changes that have taken place in personnel. It is inevitable that the young must in the natural course of events succeed the old, but in this case the industry has profited to a much greater extent than ordinarily would be understood through this platitudinous statement, for the improvement has not resulted so much through the increased energy and enthusiasm of youth as i has to the fact that these men have entered the game fortified by the technical fundamentals which the older men lacked. Just how important this scheme of procedure appears to the American Malleable Castings Association can be illustrated by the following:

"This association has decided to establish a Bureau of Inspection, the object in part being in the nature of a guarantee to the purchaser that the castings of the membership will be in every way as represented by their test bar reports and their claims in general, but equally important it is proposed that the men selected as inspectors shall possess a technical education and that they show promise of executive ability in order that they become logical candidates for vacancies at the various plants. Before starting in on their work the men must take a preliminary course in the metallurgy of malleable iron in the author's laboratories, and a subsequent course in inspection at a number of the plants in order that they will be competent from the start."

The author feels confident that future advancement in this industry must come in large measure through improvements in metallurgical apparatus. An attempt has been made in this paper to show that creditable progress already has been made and it has been indicated that further developments are more than possible of attainment. This paper was written with the idea of stimulating interest and inspiring activity in this particular direction.

Bright Future Awaits Malleable Industry

The rationale of the process has been pretty well worked out and such matters are pretty well in hand for the black heart type of product, but caution must be exercised if future developments give promise of a modification of this type of product, for the one vital thing to keep in mind at all times is the matter of machinability. It is in this particular that malleable iron excels and no change in character of product will be able to successfully replace the other, whose characteristics operate to nullify in the least this valuable and unique property.

What, then, are the possibilities for the near future? Possibly the following simile will answer this question: When a juggler starts to learn his tricks, he begins with simple stunts which he awkwardly muffs and fumbles until through lengthy practice he masters the first one. He practices the first with two balls, then with three, and then four and finally he finds that he can use six with as much ease and accuracy as two. We are in his position exactly. We started with low ultimate strength and elongation, made many muffs as we raised the standard. Some weeks ago we received a standard tensile test bar among other excellent ones, that showed over 60,000 pounds ultimate strength and 33.5 per cent. elongation. This means that while we can now juggle four balls at the present time with great accuracy and do fairly well with five, we can only do the six-ball trick on extremely rare occasions. We have proved however that the trick is possible of accomplishment and if it can be done once, it can be done practically all the time, although only at the cost of patience and practice. When this time comes double your capacity, for there will be an unlimited demand for a guaranteed product of such strength and ductility.

PLATING AND POLISHING DEPARTMENT

Question.—Several months ago we equipped our large tank for a hot nickel solution. The solution used identically the same as we previously used cold with one exception, the density of the present solution is about double the former solution. With either of these solutions operated at normal temperature of air in the plating room we can produce a beautiful white background on our stove castings in one hour, in fact the dense solution yields white deposits of nickel in twenty minutes. Now, if we heat this concentrated solution to about 100 degrees Fahr. the deposit is dark, a dull gray, and the backgrounds are anything but pleasing to the eye. If the temperature exceeds 100 degrees the deposit is actually valueless as a finish for stove castings. This dense solution was diluted to the density usually employed with ordinary double sulphate baths and the results were equally as unsatisfactory, although of a slightly different character. We have experimented with the hot solution in an endeavor to improve results without adding chemicals to the solution. We have failed to get the white background. Will you kindly advise us of a method which will permit the use of a hot nickel solution in the production of silvery white backgrounds on gray iron stove castings?

Answer.—Hot nickel solutions have their disadvantages as well as their advantages, and the dull, dead appearance of the nickel deposits from hot solutions is a distinct disadvantage when these solutions are used for plating stove castings which have backgrounds. We have succeeded in producing very fine results by using five ounces of boric acid per gallon of solution and nickel chloride instead of the more commonly employed conducting salts, and using care in the maintenance of a solution temperature of 80 degrees. It has been observed by numerous platers that hot nickel solutions "throw" better at moderate temperatures than at extremely high temperatures. An ordinary nickel solution which yields bright deposits at 65 degrees Fahr., will usually yield very satisfactory white deposits when operated at about 80 degrees Fahr. If the temperature is increased to 90 degrees the deposits may become darker in tone, and at 100 degrees a blue shade spoils the appearance of the finished casting. Much depends upon the current density employed. We would suggest that you operate the nickel solution at about 80 degrees with a current density of approximately ten amperes per square foot. Boric acid not in excess of 5 ounces per gallon of solution will aid in getting the silvery whiteness you desire.

* * * *

Question.—I am arranging a plating plant to process an output greatly in excess of any previous year's record. It occurred to me that possibly a combination copper solution would be a valuable solution to instal. Our products consist of sheet metal stampings soldered when assembled, the plating operation is performed on the assembled, article. Would the solder cause us trouble either directly or indirectly? We cannot use an electric cleaner on some of our goods because the solder is attacked. Would the action be similar in the copper solution containing appreciable percentages of cleaning compounds?

Answer.—The copper-cleaning solution may be prepared so that soldered articles may be cleaned and coppered at one operation with perfect results if care is exercised in the introduction of the cleaning compound; an excess is to be avoided. The cyanide content will probably be required to be greater than when plain sheet iron or steel is processed. The only cases of failure in cleaning and coppering soldered articles in one operation which have come to our attention were caused by the careless use of solutions originally prepared for processing plain steel or iron; the caustic properties of the cleaning compounds were responsible for the trouble. When these solutions were reconstructed by the addition of copper salts and cyanide and operated at lowest possible temperature consistent with respect to cleaning, success followed. If the two or three bath method of cleaning is used the real damage may occur in one of the cleaning solutions previous to introduction into the copper solution. Personally we favor the employment of a good cleaning solution which acts quickly, say thirty seconds, then transfer directly to a well-balanced copper solution free from sodas or cleaning compounds, a simple copper carbonate or copper cyanide and sodium cyanide solution, operated at approximately 200 degrees Fahr. with 5 volts. Strike with highest possible current density, and if a heavy deposit is required for buffing reduce the current to about 10 amperes per square foot. A ten-minute deposit at this speed will suffice for all ordinary purposes. Solder, if present on the surface of iron or steel articles, will be attacked by almost any alkaline cleaning solution if the treatment is prolonged beyond reasonable limits. A mild cleaning compound may contain some caustics and ruin a soldered article if employed as an electric cleaner. Usually the period of cleaning is permitted to continue too long. One-half minute should be suffiicent. If 5 volts will not do the job, increase the time of treatment. One operator we have met who is very successful in plating soldered articles uses a solution of: hydrochloric acid, 25 parts; sulphuric acid, 25 parts, and water, 50 parts, with lead strips as cathodes, and the soldered articles as anodes, 10 volts and 15 seconds' treatment gives the surface a clean condition, which is evidently the correct thing. The quickness with which this treatment is performed is probably responsible for much of the success attending the operation. Unless you are required to finish the soldered articles in copper we would advise the total elimination of copper-plating, as equally as perfect results may be obtained by nickel-plating direct on the steel, and less operations are required, and the chances of failure are decreased with each reduction in preparatory operations. Try this first.

* * *

Question.—Please inform me of a method which I can use to produce a steel grey color on brass. The deposit or coloring film must permit of relieving on portions of the articles. Nickel flash does not meet the requirements.

Answer.—Try an arsenic solution composed of 10 ounces of white arsenic, 4 ounces of white stick caustic potash in 1 gallon of soft water. Dissolve the potash in hot water, add the arsenic and boil the solution until the arsenic is completely dissolved. Pulverize the arsenic before adding to the solution. In case complete solution of arsenic is difficult a small quantity of the substance remaining undissolved will do no harm, but it must be remembered that the undissolved portion does not aid in the results required. Use solution cold with a current tension of from 2 to 3 volts. A ten or twenty minute deposit will be quite sufficient for your purpose; lacquer after relieving.

* * *

Question.—Admitting my inexperience, but assuring you of my sincere desire to master the problems which beset me daily as I operate two nickel-plating tanks in a small shop. I wish to ask for your opinion on a matter respecting current strength in plating. We have been plating 400 sheet brass stampings strung on copper wire per load, with 100 ampere of current; time of plating was one and one-quarter hours. Now we plate the same brass stamping on holders made from wire, and find that we can place 600 pieces in the tank per load. I have not been able to adjust the current so that a deposit of 1¼ hours would withstand the buffing. Can you suggest anything which might assist me to get a deposit equal to that obtained on copper wires and in the same time or less?

Machinery will Revolutionize the Foundry

The Writer Sees in the Future, the Foundry Worker Holding His Head Up on a Par With Those of Other Departments

By D. McNUBB

THAT MACHINERY will ultimately revolutionize the foundry business, the same as it has done with practically all other branches of industry, is an indisputable fact, but just how soon is of course a matter of conjecture. From the point of view of the conscientious, hard-working molder, the time should be postponed to some indefinite period, but to the studious, deep-thinking, progressive molder, who has carefully weighed all the arguments, both pro and con, it must certainly be apparent that if the foundry, the molder and all things appertaining thereto, are not to be relegated to the archives of the forgotten arts, molders must shake off their antipathy towards improvements and give all the encouragement in their power towards making the foundry business a profession to be proud of instead of the joke that it now is. Everyone marvels at the molder for slaving himself the way he does in this twentieth century, while other mechanics and even laborers, prefer to watch a machine do the work.

Hod carrying, cement mixing, trench digging, in fact everything in connection with the building trades, which can be switched over to the machine has been switched over, yet it has not lessened the demand for builders, laborers, nor reduced their wages. Now to get back to our own work: let us leave out the matter of brute labor and just talk about skill. How does the molder compare with the machinist? Let us first look at the machinist and see what he has to do. He turns shafting, faces off pulleys, bores out cylinders, etc. These are all plain straight jobs, right in front of his eyes, where he can see every move that he makes, and where a mistake could not be anyone's fault but his own, and still the machinists are in demand and are well paid. Machinery did not drive the machinists' trade out of existence. On the contrary it improved it the same as it improves every trade.

Now as regards the molder, doesn't his work call for just as high a degree of skill as that of the machinist? Molding a cylinder or a pulley is just as big a trick as doing the machine work on them, and in addition to the ordinary skill which is called for in other trades, the molder is called upon to work, as it were, in the dark. He cannot see everything staring him in the face, as is the case in the machine shop, but he has to rely on his skill and experience to guide him in setting his cores and closing up his mold. Now if machinery is devised, which will do the labor portion of the molding and leave the skilled part to the man, it will not put men out on the street, any more than it did in the machine shop, neither will it reduce the wages. It will simply increase the output of the foundry with the same number of men, and thereby make production less expensive and increase the demand for foundry-work.

But, like the machine shop, there will always be jobs which call for a much higher degree of skill than others, and the molder who can take his hand tools and do work which calls for this system of molding will be in the same class as the machinist who can work at a vise and do hand fitting. Now the class of machine shop work which I have mentioned, such as turning, facing and boring straight work is of course the simplest kind of machine work which the machinist is called upon to perform, and of course in the foundry there are innumerable jobs of equally as simple an order, but in the machine shop the machine does it, while in the foundry the man prefers to do it himself.

In large manufacturing plants where thousands of duplicate parts are required, the automatic machine removed the need of skilled machinists, even to the extent of permitting women and children to operate the machines, but usually employing a more or less unskilled class of workmen. This state of affairs will of course exist in the foundry, and does exist even in foundries where machines are not used. Where the simplest class of molding is done and where a large day's output is expected, the man who works entirely by hand is certainly not getting much out of life, whereas, if he had compressed air, electricity, etc., to do the heavy work he would have a much nicer job. I, as a molder of the old hand-work variety, have come to the conclusion that if I had it to do over again, or worked in the foundry at all, I would not drag myself to pieces, as I have done in the past, if I could avoid it. There are three things which I never admired about a foundry, viz. shaking out molds, carrying iron to pour the molds with and lifting until my eyes bulged out. To this might be added cutting over sand heaps, shovelling sand into molds and ramming the molds. Now none of this work calls for much skill and every bit of it can be done by power, and I cannot see for the life of me why molders should object to its being done that way.

My own pet hobby is the purifying and conditioning of the air in the foundry, and when this is accomplished, and the men are not always sticky with sweat, and covered with black dust, which sticks to the sweat, making them look like demons, there will be one long step in the direction of the proper kind of efficiency.

It is no my purpose to enumerate the different labor saving devices which are on the market, nor yet to make definite suggestions regarding possible improvements, but still I am convinced that anyone who cares to look into matters with an unbiased mind, will agree that sand can be tempered by machinery and delivered to the molds by clam shell buckets, or by sand conveyors of some kind, more easily than by the shovel in the hands of the molder. A jolting machine will do some classes of work far better than can possibly be done by hand and will get the job out of the way and make room for the next one in a much shorter time than it could be done by hand, and at the same time save expense and also the drudgery of the molder.

Power squeezers, pneumatic rammers, pneumatic hoists for lifting copes and drawing heavy patterns are certainly superior to the hand ramming and "armstrong" method of lifting.

As I have often pointed out there are jobs in the foundry, the same as in every business, where skilled mechanics are indispensable and where hand work must be resorted to, and the demand for men to fill these positions will always be greater than the supply. But apart from these jobs there are the other lines, such as farm implements for example, which were formerly done entirely by hand. This class of work never appealed to me, but I have tried it out and can speak from experience. I worked one season in a large plow shop, and my job was that of molding a wheel. It was considered to be one of the best jobs in the shop, although a little bit heavy. That is what I was told when I was preparing to make a start. The pattern was made of cast iron and weighed 70 pounds. It was fitted to a follow-board, which added some 40 pounds more to it. The flask was about 30 inches in diameter and I used to put the sand into the drag with a shovel, and then between the shovel handle and the butt of the rammer, I made it secure. I struck it off with a straight stick and bedded on my bottom board and clamped it up. Now anybody with a genius for mathematics, can easily figure out that this much of the mold would weigh pretty close to three hundred pounds, that did not matter. It was wrong side up and had to be rolled over and I was the man who was paid for doing it, so over it had to go. The cope now had to be done in a similar manner with the shovel and rammer, after which I had to call my partner to assist me to lift it off. The seventy pound pattern, I had to draw alone, and then get my partner to help me to close up. Now in making that mold I had four good heavy lifts, besides lifting for my partner in return

(Continued on page 39)

Foundrymen Should Know Cost of Operating

The Manufacturer Who Sells His Products Without Knowing Cost of Production is a Menace to Honest Business—Cost Keeping is Not a Luxury

By ROBERT E. BELT

The following paper read at the convention of the National Founders' Association, New York, by Robert E. Belt, secretary-treasurer of the American Malleable Castings Association, introduces a subject which is too frequently neglected.

To foundrymen, the subject of costs has not the same general interest as have other subjects which seemingly are more closely related to production or to profits. When the matter is carefully analyzed, however, the question of what it costs or will cost to produce a particular type of casting and at what price it can be sold is more closely related to the objects of conducting a business, namely profits, than any other subject to which the foundryman is required to give consideration. The effect of costs on the profit and loss statement is a most direct one and a distorted relation between costs and selling prices produces a serious situation. The longer the executive is in ignorance of a disturbed relation between costs and selling values, the more serious the situation becomes.

Accurate cost information is undeniably the only true basis upon which to make prices, and arbitrarily quoting a price irrespective of the actual or of the normal cost of production almost in-invariably produces bad results both to the individual company and to the industry as a whole. The foundryman's most dangerous competitor and the industry's greatest menace is the fellow who is selling his product without a knowledge of its cost of production. It is obvious that one should know the cost to produce each kind of work he manufactures as competitive conditions are seriously disturbed where losses on one or more kinds of work are recovered from profits on other kinds of work.

Practically all foundrymen recognize the importance of accurate and dependable technical information in the management of their plant; of determining the constituents and properties of their iron, and of melting under laboratory control; of the advantages of paying labor on the piece-rate basis; of the advantages of machine moulding over hand moulding; and the importance of modern methods of handling and conveying materials. While foundrymen admit that there are advantages in the more modern technical and physical methods, they are extremely slow to admit that there are equal advantages to be derived from modern office methods—methods by which the operating efficiency of the foundry can be watched and by which true costs of the product can be determined. No matter how modern and improved may be the technical end of the business, its successful conduct is not assured unless the cost of the various classes of product is known and the product disposed of at a figure in excess of cost. The successful conduct of any business depends upon selling the product at a profit, and in order to be sure one is selling at a profit the accurate cost of what he is selling must be known.

Experience has demonstrated over and over that in the production of castings it is not safe to base a selling price on an average cost. In a jobbing foundry, the cost of the work of no two customers is the same; the cost of no two patterns of castings is the same. With almost every order, conditions vary, and the cost of production always varies with the conditions. The variations in cost should be known, studied, analyzed and watched.

Whether the product is grey iron, malleable iron or steel castings, the most satisfactory cost in a jobbing foundry, in my opinion, is a cost on each principal pattern of casting. The first impression is that to get a quarterly or a monthly cost on each principal or long running pattern of casting would involve an immense amount of clerical work. Experience proves that is not the case, particularly where the cost system is free from complications and from hair-splitting refinements. The manufacture of castings is not a complicated process and I have never been able to see why the accounting need be more complicated than the manufacturing process itself.

Next best to a cost on each principal pattern of casting is a class cost, the castings being classified by weight per piece divided into plain and cored classifications. For grey iron foundries engaged on light work of not extremely dissimilar types the weight classification for costing purposes usually gives fairly good results.

Adequate costs, apart from their value for price making purposes, are an index of operating efficiency. With properly prepared costs, the relative efficiency of the different departments of a foundry can be watched and compared. The current results obtained in each department can be checked against those obtained in the past, thereby showing increases in efficiency, or the reverse, and the results of improvements in plant practice. Complete and properly designed cost statistics will be found to exercise the important and productive function of lowering costs and holding them at the lowest possible level.

Foundrymen who have not installed cost systems ordinarily have a number of reasons for not doing so. One of the objections is the feeling that exists in the minds of many that their particular business is so different from others that no system which could be operated in a practical manner would give them dependable results. It is true that some lines of foundry production and foundry practice lend themselves more readily to the determination of costs than others, but it is also true that no line is so complicated or the plant organization so complex but that a workable system can be devised and operated in a thoroughly practicable manner which will give reasonably accurate results.

The most common objection is that of the expense of operation. Many foundrymen are of the opinion that a cost system means an interminable amount of detail and red tape and the employment of a number of additional clerks. It is true that some extra labor may be required, but not to the extent that most foundrymen believe. There is in nearly every office that is not systematized, and where costs of production are not determined, sufficient unproductive clerical work to cut down the extra labor to a minimum. In many foundries where the office work has been systematized, and where pay-roll and cost work have been unified, it has not been necessary to employ any additional help at all.

The foundryman who is fortified with an accurate knowledge of his costs of production always has an advantage. Every foundryman should know his costs, regardless of cost methods. It is far better, however, if each distinct branch of the industry were to adopt uniform methods, as unfortunately, differences in accounting methods do produce different results.

The maximum economies in the production of castings are verp largely the result of a study of comparative costs of production, thus enabling the management to maintain a standard of efficiency in keeping with the more efficient results. The most conclusive proof of the value of accounting from an operating standpoint is the fact that one of the first moves made by a large corporation or holding company operating a number of plants manufacturing a given product upon acquiring an additional plant is to change over the accounting system to the uniform one in use at the other plants of the company. No large corporation to-day attempts to conduct its business with non-uniform methods of accounting, or in other words, without a comparison of costs at the different plants. It is imperative that a comparison be had as only in this way can the relative efficiency of the different plants be determined. If operating inefficiency is disclosed in this way in a large corporation operating various plants, should not the same be true in an entire industry, or in a distinct branch of an industry, through the use of similar methods?

The advantages to an industry of uniform accounting methods from the standpoint of unfair competition are of equal importance. There is a form of competition to which a foundryman cannot object, even though it cannot be met, and that is the competition of the man who prices his work on the basis of cost and whose lower price reflects advantages by reason of efficient methods of production. The competition, however, to which objection can be rightfully raised is that of the man, who, having no dependable knowledge of his costs sets prices which preclude the possibility of there being an adequate profit in the business for anyone. It is this situation that a knowledge of costs largely corrects for rarely does a man price a product at less than cost when he knows its cost, but if he does not know its cost the price unknowingly may very likely be less than cost. Uniform accounting, which recognizes the fundamental principles applicable to cost-finding in the particular industry, has the effect, therefore, of reducing unfair and unintelligent competition, but uniform accounting in itself does not regulate prices and does not in any measure restrict competition.

The adoption of uniform accounting methods, does not mean uniform costs. There are and always will be differences in costs of production. It is natural and right that there should be differences in costs, but such differences as do exist should represent actual conditions resulting from better plant organization, higher efficiency, more favorable location, and other operating factors. In the industries where uniform cost methods are recognized and followed the members know that differences in costs are due to operating factors as their costs are built up in a like manner and that they include like elements of cost. In competition the companies can feel that they are competing on an equal basis and have the satisfaction of knowing that they will not be called upon to meet a ridiculous price that has been based upon widely different costs determined in an entirely different manner.

The conditions that were found to exist in one of the branches of the foundry industry prior to an effort to improve and standardize cost methods are typical of conditions in other branches where no special cost educational efforts have been made. About three years ago, in the branch of the foundry industry referred to, a test was made of the competitive conditions which resulted where concerns were either using different accounting methods or guessing at their costs. Two castings each were furnished forty-three different foundries which were asked to quote on an inquiry for 10,000 pieces of each pattern and to give their total estimated cost of production on the basis of $40.00 iron delivered. With the actual castings before them and the price of iron fixed you would not expect any great variation in estimated cost; but here is the result of the inquiry: Of the forty-three cost estimates, on the one casting, about one-half showed a fairly narrow range—from about 7¼c to 8¼c per pound. Those were the foundries that were in a position to prepare an estimate on some more or less accurate basis. The variation in the estimated costs of these particular twenty odd foundries did not cause any special concern. It was the other half of the concerns, barring a few unreasonably high estimates, which were the ones that were crippling the industry through the establishment of a price which precluded anyone from getting business at a living price.

As compared with a normal and fair cost at that time (on the basis of $40.00 iron) of about 8c. per pound, there was one estimated cost of a fraction less than 5c.; another at 5½c.; and six others under 6½c. Excluding one abnormally high estimate, the range of the forty-three cost estimates was from 4.9c. per pound to 11.6c. per pound.

On the other casting, a more costly one to produce on account of its lower output per molder per day, the cost estimates were still considerably wider. Here again, the estimates of the companies which has dependable records upon which to base their estimates did not vary widely. They were from 12½c. to 14c. per pound. Compared to these normal estimates, there was one of 8.3 and another of 8.6c. Of the forty-three foundries estimating on this particular casting (all using $40.00 iron as a base), there were two estimates over 20c. per pound, and six estimates under 10c. per pound.

With conditions such as those existing, is it any wonder that the foundry industry is a hazardous one and that a good proportion of the aggregate tonnage, under normal conditions, is produced without profit? Is it any wonder that there is so much dissatisfaction among customers when they learn that others in their line are securing their requirements of similar castings from a trust-to-luck foundry at prices fifty per cent. less than they are paying? There probably isn't another industry where there is so much "shopping around" for prices as there is in the foundry industry and this is the direct result of a knowledge on the part of buyers that many foundries do not know their costs and that probably they will be able to get their requirements from these shorter-sighted ones who just naturally know their costs, and who manage to exist for a time at least by selling without profit.

The investigation referred to, apart from disclosing the futility of meeting prices which were made without a realization of the actual costs of production, revealed the fact that there was almost as much variation in the estimated cost of moulding as in the estimated overhead; that there was as wide a range in the price that the moulder would be paid per mould for moulding as there was in the total estimated cost. In the same locality, where practically the same labor rates prevailed the moulders' price per mould for the same sized flask would vary as much as four cents, or the equivalent of $20.00 per ton in the final cost of the casting.

A study of this important cause of variations in costs as among different plants disclosed that piece prices in most foundries—the foundation of costs—were determined by rule-of-thumb methods and that there was no common basis upon which different plants could determine an equitable piece price for moulding a given type of casting. An effort was made therefore, to determine piece prices for moulding in a somewhat scientific manner along basic lines or standards which would be of general application.

For bench or squeezer moulding, as an example, it was found that the moulding price per mould could be based on a series of well defined operations or factors, such as the cubical contents of the flask, the number of cores and chills to be set, the handling of the pattern and flask, etc. These, in the main, constituted common factors and a standard value was placed upon each, such as a factor of 30 for each 1,000 cubic inches of flask content up to 2,000 cubic inches, a factor of 50 for each 1,000 cubic inches in excess of 2,000, a factor of 2 for each small core set, 3 for each moderate size core set, 4 for each large core and 8 for each complex core, a factor of 12 for handling a plate pattern of all the factors expressed in cents represented the relative value of the particular job. To reduce the sum of the factors to a price reflecting the prevailing wage scale of the locality, all that was required was to multiply by a coefficient which would produce the average desired earnings per hour.

The above plan is in successful operation by a large group of foundrymen and it is assisting materially in the standardization of plant practices and in the elimination of artificial differences in costs. It is only another effort for the establishment of equitable earnings of employees and for the maximum reduction of guess work in one of the chief elements in the cost of a finished casting.

The principal reason, I think, that cost information has not attained the position in the foundry industry that it rightfully occupies, is the belief of the average foundryman that any kind of help is good enough for the office; that an office boy in a year or two is fully equipped to take charge of the company's cost work. This is a serious mistake, particularly as most foundry executives have neither the time nor the inclination to analyze costs in order to determine the conditions which resulted in an unusually high or an abnormally low cost. This is the work of the accountant for the assistance and enlightenment of the executive and it is not the work of the evecutive. It is this phase of cost accounting—the real object and purpose—in which the so-called accountant is so often deficient and as a result, unless the executive realizes the accountant's deficiency he is most likely to decide that costs are of little value and that the work of the accountant is unproductive.

The shortcoming, primarily, is the accountant's, and secondarily, the executive's. The cost accountant who neglects the proper application of his work and is not inclined to read and analyze and present his findings, is not filling his mission and the executive who condones the omission of that essential in the accountant has either never been awakened to the possibilities of accurate and complete business information or is deficient as an executive.

There are many foundry executives who manifest but little interest in cost results and when the accountant is of the same trend of mind, it is not at all surprising to find a feeling which is adverse to cost work. This latent faculty of the executive, however, is easily and quickly exercised when the accountant presents the results of his work in a manner which means something to the executive. When the executive sees that accurate and complete cost information results in the reduction of expenses or in an increase in selling prices, he is going to realize the importance of the work.

The writer well recalls one executive, the president and general manager of a large foundry, who until recently had always looked upon the expenses of his small cost department as a necessary evil, but who has completely changed his conception of costs and their value through the employment of a chief accountant who has a realization of the purpose of costs and who presents his information and results of his findings to the executive in a clear and convincing manner. To-day this executive looks forward to the monthly statement of costs with more concern than to any other statement which passes over his desk. He sees where the current cost reports mean and have meant greater profits and to-day when the management of this foundry wants to know the effect on costs of the acquisition of new equipment or of the installation of a moulding machine for a particular job, it is the accountant from whom data and an opinion are requested and it is largely his findings which determine the action of the executive. ,

The question of what the foundry cost accountant can or should do to reap the most benefits from his labors and thus to be of the greateset service to his employer is one somewhat difficult to answer, as conditions vary. Generally speaking, however, the work of the accountant shou'd at least cover two fields, namely, ascertaining costs, and presenting them in an analytical and comprehensive manner. These are the accountant's essential duties.

The department of the foundry management for which an analysis is made will largely determine the nature and character of the accountant's report. Generally, an analysis and report should be made for the operating or manufacturing executive, for the sales executive, and for the general administrative executive.

The operating executive of a foundry should be furnished with current comparative unit costs in sufficient detail to clearly illustrate the factors influencing cost fluctuations. Departmental labor costs comprise the most fruitful source of statistical and analytical information which can be furnished the plant management. Unit labor costs of the several departments can be readily shown from which the operating executive can easily see exactly where the labor costs were abnormal. They should be presented in comparative form, showing increase or decreases in cost unit of product, and it is well to chart the cost trend for a period of months. In addition to presenting comparative costs of labor per unit of product by departments, it is well also to show comparative earnings of employees per hour, arranged by departments and by classes of labor. Various other statistical and analytical data can be profitably prepared for the operating officer such as the average production per moulder per hour classified by types of product and methods of moulding, the average weight per piece of castings produced, an analysis of the gross metal charge showing the loss of metal from oxidation, the percentage of good production, the consumption of fuel, sand, fire-brick and other materials per unit of output. Other statements of equal value will suggest themselves to the alert accountant.

The character of the information which the sales department needs differ materially from that required by the manufacturing department. The primary interest of the sales department in costs is in connection with the establishment of selling prices, and therefore, patterns of castings or classes of castings covering past and future periods are of the most concern. In fact, the real concern of the sales executive should be in what the costs will be for the immediate future and it is here that the accountant has a real opportunity to use his knowledge and experience in forecasting costs. His forecasts, however, should a'ways be based on the actual cotss for the most recent period, modified by existing current conditions. He will have to take into consideration many factors of which may be mentioned variations in output, in material costs, in labor costs, in overhead, etc., but with the accountant's first-hand information and with his first-hand knowledge of causes and effects, he is in a position to forecast costs with remarkable accuracy.

In most foundries of the smaller size, both sales administration and general administration are under the direction of the same official. When this is the case, the analytical reports to be submitted would not differ from those which wou'd be prepared for the sales executive, but in addition, they should embrace a summary monthly profit and loss statement, arranged to show the month's shipments, the cost of the shipments, with beginning and closing inventories of raw materials, work in process and finished castings, and the month's profit. The statement should show both aggregate values and unit values. The unit values and profits for the month should be presented in comparative form, month by month and cumulative by months.

Needless to say, statements should be standardized and the accountant should prepare them regularly and promptly and have them reach the executive's desk with unvarying promptness. The executive will learn to expect them and even though the statements at first may not receive the consideration they deserve, it will not be long until they will be awaited with keen concern and will play a most important part in the administration of the affairs of the business.

MACHINERY WILL REVOLUTIONIZE

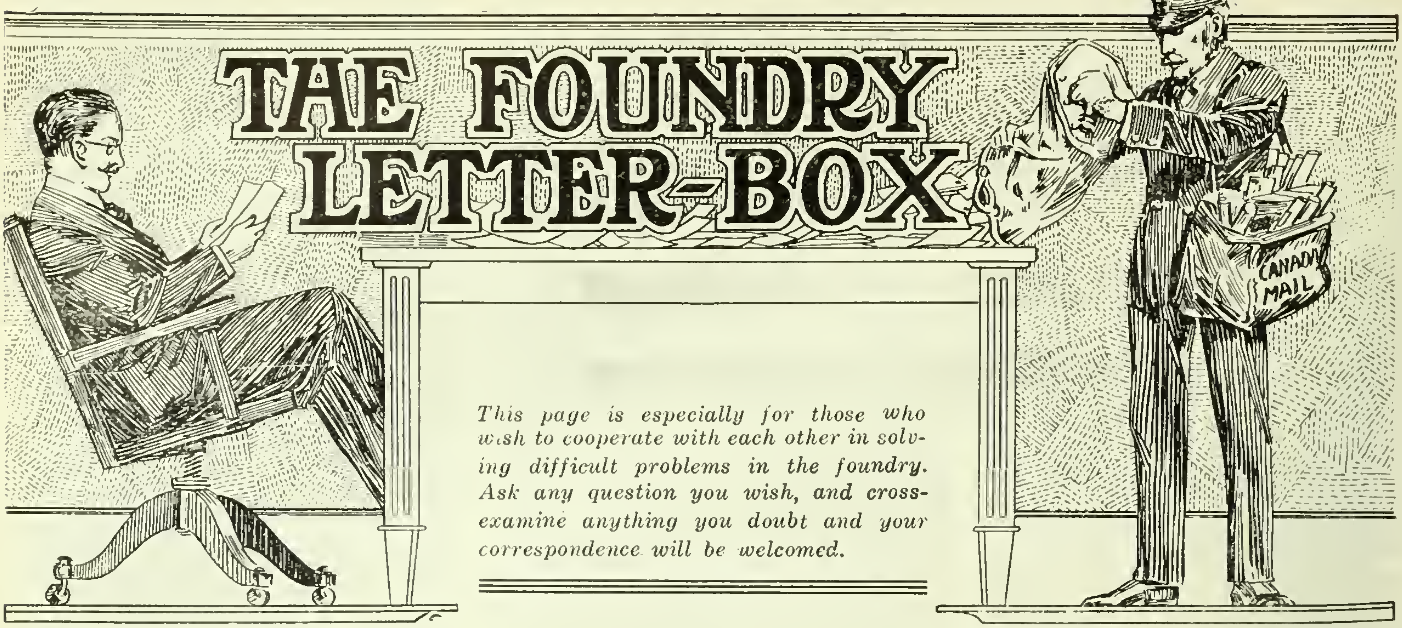
(Continued from page 36)

for what he did for me. I had to do that twenty-one times in a day in order to make my wages, making 84 heavy lifts on my own floor and about half that many more on my partner's floor, in addition to wielding the shovel and rammer to the extent of using up a sand heap about thirty feet long and three feet high and then finishing off the day by lugging about a dozen, full ladles of iron.

Compare this with ramming, shoveling, rolling over, lifting, pattern-drawing and pouring with the aid of electricity or compressed air, and I am confident that any right thinking person will agree with me that there is no comparison.

The shop which I have just referred to was no sweat shop, but was a strictly union shop with wages and conditions satisfactory to everyone. The company was fair to the men in every way, and the men were as good a lot of fellows as I ever worked with, so I will have to conclude that it was a good average sample of hand-operated agricultural foundry.

As the demand for castings increases from year to year and the apprentices in the foundry decrease, it is obvious that the machine will be requisitioned to make up for the shortage of molders, so, all things considered, the molding machine must and will force itself into the foundry, and once it is thoroughly installed, no one will ever want to go back to the old system of lifting and lugging. No manufacturer stands higher in the estimation of the working class than Henry Ford, yet no one could work the machine system in a more efficient manner than the Ford Motor Co.



This page is especially for those who wish to cooperate with each other in solving difficult problems in the foundry. Ask any question you wish, and cross-examine anything you doubt and your correspondence will be welcomed.

PREFERS LINSEED OIL

Editor, Canadian Foundryman:

In your February issue of Canadian Foundryman, Thomas Langley, of the firm of Langley and Austin Brass Works, Galt, Ont., takes exception to your recommendation of using linseed oil as a binder for cores used in brass bibbs, basin cocks and bath cock bodies. I am from Missouri, as the saying is, and he will have to show me where dextrine, glutrine, or any other of the " 'ines," or compounds can give the results that linseed oil gives on complicated cores, which is another feature to recommend the use of linseed oil. Two features of exceptional value are that a core made with linseed oil as a binder does not require the venting or rodding which other cores require. It is also an ideal binder for sand to be used on core machines and multiple core boxes on valve bodies.

I would suggest to Mr. Langley that he compare his cored castings made from cores with a dextrine binder and those of some other foundry where linseed oil is used, and he will see the difference if it is only in appearance.

When all the leading manufacturers of this line of goods in the States and Canada use the pure linseed oil and silica sand, don't think for a moment that they would do so at the prevailing price which linseed oil is bringing on the market to-day, if any of the substitutes would give as good results. By the use of oil you get a nice clean interior to your casting. I have seen castings on valve and basin cock bodies, that were so clean and smooth on the inside, and so free from rough surface that competitors have claimed that the castings were acid-dipped.

A feature to which I desire to call especial attention in regard to oil-sand cores for this class of work is that the cores are hard on the surface and do not allow the metal to wash the sand off the surface to float on top of the casting as it frequently does when soft cores are used. These castings are usually highly polished and quite frequently nickel-plated, and if there is any dirt it shows up bad. To overcome this, when using cheap core compounds, it is necessary to paint or dip the cores in core wash.

The only objection I have ever experienced to the use of linseed oil as a binder is that it smokes the core room when being baked and the smell is bad, but if the core oven is well ventilated, this can be overcome. The only compound which I have seen used to advantage was composed of 75 per cent. linseed oil. By the use of linseed oil a good hard open core is produced, which can be stored for a long time and not absorb moisture or in any way loose its good qualities. In conclusion I will say that I have seen some of the taps, etc., which have been made by concerns using cheap binders and they do not compare with the high grade work done by their competitors. I can furnish samples and names if necessary.

P. W. Blair,
199 G. E. Cartier Sq., Montreal.

* * * *

WANT FORMULA FOR WHITE METAL

Editor, Canadian Foundryman:

We have a call for a Memorial Plate (lettered) which has to be cast in white-metal to replace a blank already on the monument.

Through exposure to the elements these plates are now a dark slate color. The material is soft to cut and shows a white metal.

Kindly give us a formula for a suitable mixture, as we want to duplicate appearances with exposure as near as possible.

Answer:—The blank which you are replacing would make most of the material required for the new one, but that is not your question. Pure lead shows a beautiful white lustre when freshly cut, but tarnishes rapidly when exposed. If your plate was made of pure lead, it would cover all the specifications which you have submitted, but it would be too soft to recommend for the purpose. If hardened with antimony or tin, it will still look the same. Any of the anti-friction or babbitt metals which are on the market will show that slate color. If you use babbitt metal and an equal amount of lead you will have a material which will be all right for your plate. 88 of lead and 12 of antimony, would bring similar results. Antimony melts at a higher temperature than lead, but if melted first it will burn. It is better to melt the lead first, in which case it will be necessary to superheat it, and then after crushing the antimony to a dust, stir it through the melted lead.

If you prefer to use tin instead of antimony, you will require 20 of tin to 80 of lead, to make it hard enough to be rigid.

* * * *

WILL BE A MANAGER SOME DAY

The Editor of Canadian Foundryman is in receipt of a letter from a young molder who is the type of man who will make good, not only because he is a reader of Canadian Foundryman, although that is one important feature, but because he likes his work. Speaking about Canadian Foundryman he says:

"I was interested a great deal in your articles about mixing the different kinds of molding and core sands, and I also find quite a lot of good information in the paper." Speaking about his trade he says: "I feel that I should like to tell you how I came to take up molding. After arriving home from overseas on July 12th, 1919, I happened to pass through Maxwells molding shop and the foreman asked me if I would like to learn molding. I thought it was a hard proposition, but anyhow I said 'yes,' and I can tell you I never have regretted it.

Continued on page 44

Two Prominent Canadian Foundrymen Pass Away

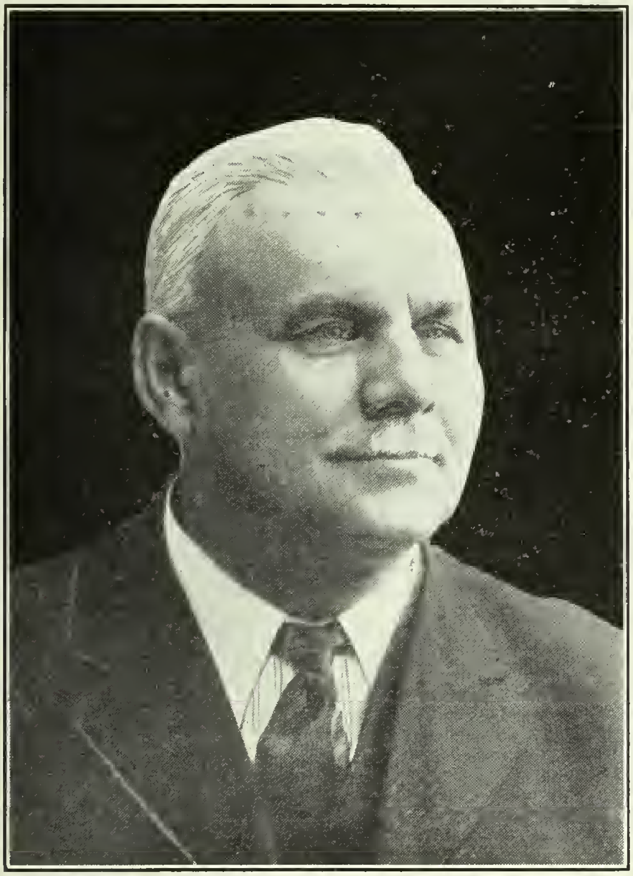
Began as Apprentices at the Trade of Molding and Worked Up Through All the Stages to the Highest Positions in Their Respective Companies

GEORGE Wedlake, Mayor of Brantford, Ont., and President of the Cockshutt Plow Co., of that city passed away at his home on March 3rd. Mayor Wedlake who was elected for a second term at the last municipal election was giving evidence at a police probe being held in Brantford, and at the conclusion of his evidence collapsed and took a slight paralytic stroke from which it was thought he was recovering. His condition, however remained unsatisfactory, and his death was not unexpected, but the news came as a shock to all citizens.

He was a Brantfordite in every particular, enthusiastic, loyal, earnest. Educated in the local Public schools before there was a High school, he started with A. Harris and Son as a molder, and served his apprenticeship there. As a journeyman molder he went to Cockshutt's to work when there were but 20 employes and five types of plows. He rose to be foreman, superintendent, vice-president and assistant to the president, assistant manager, general manager, and when Col. Harry Cockshutt was appointed Lieutenant-Governor, Mr. Wedlake was elevated to the position of President while still retaining the general managership.

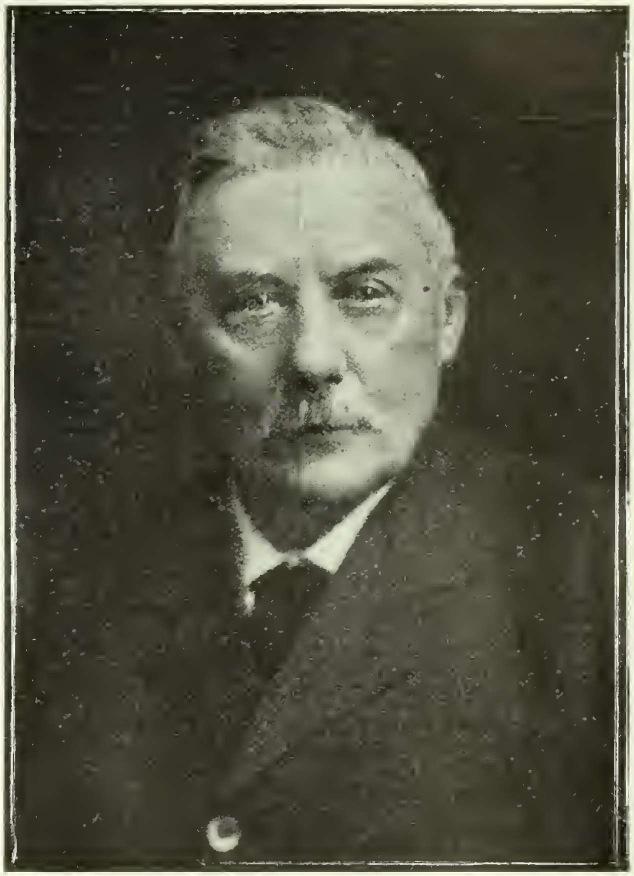
Man of Public Spirit

He was always active publicly. He served on the Public School Board, then on the Board of Health. When Hydro was brought there eight years ago he was elected to the commission, and had been a member since, resigning only to enter the Mayor's chair, which sent him back to the board. He was active in social service and the work of the Methodist Church, being known as the "father of Wesley Church," and he had been president of the Hamilton Conference Laymen's Association. His generosity was unbounded, and during the present industrial crisis not only all his civic salary, but a large part of his income, went for relief. He was actively interested in sport, helping local associations generously.



THE LATE GEORGE WEDLAKE

Mayor of Brantford, Ontario, President and General Manager of the Cockshutt Plow Company.



THE LATE HON. JOHN MILNE, SENATOR

President and Managing Director of the Burrow, Stewart and Milne Foundry Company, Hamilton, Ont.

* * * *

Senator John Milne, President and Manager Director of the Burrow, Stewart and Milne foundry company of Hamilton, Ont., died at his home in that city on March 4th. Senator Milne was one of Hamilton's most prominent business men. He was not only at the head of this particular concern but was president of the Pure Milk Co., Ltd., director of Steel Company of Canada, of the Armstrong Cartage Co., of the Spring Brewery Co., and of the Brewing Association of Hamilton. He had held various important municipal appointments during the last twenty years.

In politics he was a conservative, and was appointed to the Senate during the regime of Sir Robert Borden, Dec. 1, 1915. He was a prominent Mason and a member of the Presbyterian church.

He was born in Aberdeen, Scotland, January 22, 1839, and was educated in that city. He came to Canada in 1854 and ten years later entered into partnership with his two life-long associates who predeceased him some years ago, and opened up the well known foundry business of Burrow, Stewart and Milne, manufacturers of stoves, ranges, furnaces, scales and hardware specialties.

(Continued on page 46)

F. H. BELL, Editor

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Editorial Index

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Market Conditions

MARKET prices are gradually becoming more favorable from the buyers' standpoint but as yet there is not much demand. No. 1 pig iron is quoted at Canadian furnaces at $27.15 per ton, but this is said to be simply a base to work from; a large contract would not be allowed to slip away if a slight reduction would hold it. While the jobbing brass foundries seem to be the busiest of any of the metal working industries, there seems to still be an over stock of raw material. Prices on raw material are not as low as they should be, but the dealers contend that the price has nothing to do with selling, and that if prices were reduced they would be the losers, as they would not make any more sales. Lake copper is selling at $17.00 per hundred pounds, electric copper at $16.75 and casting copper at $16.50. Other prices are as follows:—tin, $34.00; zinc, $7.25; lead, $6.75; antimony, $8.00; aluminum, $27.00. Scrap metal is also in abundance, copper selling at $10.50, scrap brass, anywhere from $5.00 to $10.00, according to quality. Scrap zinc and lead are holding at three to four dollars per cwt. and aluminum about ten dollars. Supplies are not moving very rapidly, but on the whole, business seems to be slowly picking up.

* * * *

The Foundrymen's Convention

EVERYTHING is progressing satisfactorily at Rochester in connection with the convention. The buildings which are to be used for the exhibits as well as for the convention are those of Rochester's Industrial Exposition, which takes place in September of each year. These buildings are beautfully located and have a floor space of 75,000 square feet in the exposition buildings alone, besides other buildings for addresses and conferences.

Rochester is a city of slightly over three hundred thousand population, and along with their other industries they have thirty foundries. Another feature worthy of consideration is the fact that reduced rates are being arranged on the railroads. This has not been possible for some years, but railroad companies like all others are out for business these times.

* * * *

Not Superstition

IT MAY BE hard for the average citizen to believe, but it is nevertheless true that the depression from which we are just emerging is but a part of a regular programme, or as the saying goes, one link in a regular chain of events. If there had been no war the year 1914 and the year 1921 were due for panics the same as is waiting for the years 1928 and 1935, and so on, down through the years that are to come.

As far back as history goes every seventh year was quiet no matter what else transpired. Some of our older readers will remember the close of the American Civil War in 1865. Times were terrible and the war got the blame, but according to the cycle they would have been terrible if there had been no war.

Seven years later found Canada a young nation struggling along on its fifth year and blaming the government for the hard times which were prevailing at the time. A general election took place this year with a change in the administration. The next year found times improving and the new government got the credit. While conditions were all that could be expected in Canada, our neighbors to the south of us were going ahead at a more rapid pace and Canadians were emigrating to the United States by the thousand, and the people began to complain of the government. A general election took place with the result that a strong protectionist government was returned. Great hopes were entertained that times would improve, in fact a boom was predicted, but it did not materialize, as another seventh year was drawing close. This seventh year was 1879 and unemployment was rampant. However, the protectionist government struggled with the tariffs and when the panic wore itself out, and passed along, protection got credit for the good times which followed. 1886 found us struggling again, as did 1893, 1900, 1907, 1914 and 1921. During these years Liberal and Conservative Governments rose and fell. Both saw good and bad times. Both took credit for the good times and blamed the opposition for the bad times. The present government is bound to see good times during their entire career, and when the next general election is due, prosperity will be at its zenith, but according to the cycle of sevens based on past history, it matters not what government is returned at the next election a depression is due in 1928. This may sound amusing, but it has facts at its back to prove what has been, but to swear by it for the future is not so sure would seem safe enough. At any rate good times are due for the next half-dozen years and we should aim to be prepared for whatever comes our way in the seventh year.

Foundrymen Meet to Plan The June Convention

On Monday, February 20th, President Bean and Secretary Hoyt met with the foundrymen of Rochester to aid in organizing the local committees. An executive committee of eight was selected, with Norman Van Voorhis of the Galusha Stove Works as general chairman. On the following day the executive committee met and named committee chairmen as follows: Reception and Information, Louis P. Willsea, of Willsea Works; Entertainment, H. G. Hetzler, North West Foundries, Inc.; Finance, Schuyler H. Earl, Gleason Works; Hotel, A. H. Jones, American Woodworking Machinery Co.; Golf, Matthew Elliott, Erie Foundry Co.; Publicity, Edgar F. Edwards, Rochester Industrial Exposition Association.

According to custom, W. R. Bean as president of the A. F. A. will be chairman of the banquet committee. He has named past presidents Alfred E. Howell and J. P. Pero, representing the A.F.A., George B. Pettingill of the Symington Co., and Louis P. Willsea of Willsea Works, representing Rochester, as the other members of this committee. All Rochester foundries will be well represented on the various committees and the complete personnel of each will be announced later.

The Hotel committee organized very promptly and formulated plans for handling the convention attendance. This committee wishes it to be announced that hotel reservations may be made direct with the hotels or through the committee. Mr. Joseph Smith, care of Powers Hotel, is secretary. An alphabetical list of hotels which have guaranteed a certain number of rooms appears in this bulletin. These hotels have been instructed not to make reservations for parties in excess of six in number until such reservations have been referred to and O.K.'d by the committee. The purpose of this to to check the unfair practice of reserving large blocks of rooms for future distribution, a practice which discourages attendance and makes difficult the work of providing for members and guests.

For a number of years it has not been customary to name any hotel as Association headquarters. Official headquarters, registration, etc., will be located at Exposition Park, where all the activities of the week will centre.

Convention Hall, where the general and technical sessions will be held, affords excellent accomodation and is located less than a hundred yards from the Exhibition buildings. The dining hall is located a little west of Convention Hall and near Exhibition building No. 5. This group of buildings, forming a quadrangle in a beautiful park, will provide every convenience and comfort. Exposition Park is located a mile and a half north and west from State and Main streets, the centre of the city; three car lines run direct to the entrances; splendid facilities for parking automobiles are provided in the park.

You will hear much more about the good things Rochester has to offer and that she will give her best, all who have visited there and observed the "Rochester Spirit" feel certain. His Honor the Mayor for the City, the Chamber of Commerce with over 4,200 members, and the foundrymen of Rochester, have all pledged this. The chairmen and members of all committees are determined to make this a banner convention and one to be remembered by foundrymen from all over the United States and Canada. An interesting entertainment program is being prepared to supplement the splendid technical program which is already assured.

See notice elsewhere of special rates for this convention. All roads will lead to Rochester in June.

List of Rochester Hotels who have guaranteed rooms and rates for the A. F. A. Convention:

Hotel Berkeley, Main and Franklin Sts.

	Room rates
Two persons, without bath	$2.50
Two persons, with bath	$2.50-$5.00

Bristol Hotel

Double bed, without bath	$3.00
Double bed, with bath	$4.00
Cots	$1.50

Chapman House, 60-66 South Ave.

Two persons, without bath	$3.00-$2.50
Cots	$1.50

Hotel Eggleston, 163-165 E. Main St.

Two persons, without bath	$3.00
Two persons, with bath	$4.00-$5.00
Cots	$1.50

Hotel Hayward, South Clinton, near Main Street

Two persons, without bath	$3.00-$4.00
Two persons, with bath	$4.50-$6.00

Osborn House

One person, without bath	$1.50
One person, with bath	$2.00-$2.50
Two persons, without bath	$3.00-$4.00
Two persons, with bath	$4.00-$5.00

Powers Hotel

One person, without bath	$2.25
One person, with bath	$2.50-$4.00
Two persons, without bath	$3.50
Two persons, with bath	$4.00-$6.00
Twin beds	$1.00 extra
Cots	$2.00

Hotel Richford

One person, without bath	$1.50
Two persons, without bath	$3.00

Hotel Rochester

Two or more, without bath	$3.50
Two or more, with bath	$4.50-$7.00

Hotel Seneca

Two persons, shower bath	$4.50-$5.00
Two persons, tub bath	$5.00-$7.00
Two or more persons, without bath	$3.50
Four persons, tub bath, two double beds	$10.00
Cots	$2.00

Seymore Hotel, 48-50 South Ave.

One person	$1.50
Two persons	$3.00-up
Two persons, with bath	$5.00

Whitcomb House

Two persons, without bath	$3.50-up
Two persons, with bath	$4.50-up
Cots	$2.00

Savoy Hotel guarantees to take care of 108 people. Rates not yet received.

Windsor Hotel guarantees to take care of 58 people. Rates not yet received.

SPECIAL RAILWAY RATES FOR ROCHESTER CONVENTION

The Trunk Line Passenger Association, in whose territory Rochester is located has authorized reduced rates on the identification plan, for our June Convention.

On this plan round trip tickets will be sold at one and one-half fare, with a minimum of $1.00 for the round trip. Tickets will be sold to members and dependent members of their families, and will be given via the same route only, in both directions. They will be sold from June 1 to 7, and will be validated at Rochester by the agents at the regular ticket offices of the lines over which they read into Rochester, and must be used returning to reach the original starting point not later than midnight of June 16th.

Following this action by the Trunk Line Passenger Association, the New England, Central, and Southeastern Passenger Associations have notified us that they have authorized the same rates from their territories. It is hoped that the Western, Southwestern, Trans-Continental and Canadian Passenger Associations to whom application has been made, will do likewise.

Under the identification plan it is necessary for the association making application for reduced fare to issue certificates duly signed by some officer of the association. Reduced fares tickets will be sold only to those who have these certificates. Further announcement will be made as to territories in which reduced rates will apply, and as to the plan of issuing certificates.

Foundry Re-opens for Business.—The Milton foundry at Milton Corner, near Yarmouth, N.S., is again open for business after lying dormant for twenty-six years. This was a flourishing business in the early sixties, and was incorporated in 1871 by Wilson, Clarke and Co. After various vicissitudes of fortune and many changes in its corporate name it finally closed its doors in 1896, and remained closed until local interests purchased it a short time ago, and after putting it in shape are again ready for business.

Two deposits of radium bearing minerals have been discovered on Vancouver Island and Voldez Island, B. C. In view of the fact that radium is greatly in demand for cancer treatment, Canada is fortunate in being able to produce its quota of the mineral.

* * * *

The Nova Scotia Coal Co., are making preparations to increase coal banking facilities and resume operations in preparation for opening of navigation. It is anticipated that other metal working industries in the steel districts of Nova Scotia will commence operations on a normal basis in the very near future.

* * * *

The Ford interests, it is reported are about to establish a plant in the Sudbury district. In view of the fact that the tract of land mentioned in the report forms part of one of the principal iron ore deposits in the province, it is surmised that it is the intention to put in blast furnaces and connect the ore into iron and steel to be used in the construction of motor ars.

* * * *

The Canadian Aluminum and Brass Co. is opening a branch at Windsor, Ont., in a part of the plant occupied by the Dominion Motor Castings Co. The Canadian Co., is affiliated with the General Aluminum and Brass Co., Detroit, and the president, Mr. J. P. Carritte states that actual work will start at the new plant during the present month.

* * * *

A peal of twenty three bells is being installed in the Metropolitan Methodist Church, Toronto, by Messrs. Gillet and Johnson, bell founders, Croydon, England. Mr. R. F. A. Housman a partner in the firm is in the city attending to the installation of the bells, and while in Canada he is looking up other business for his company.

* * * *

Canada Electric Castings, Limited, Orillia, Ont., are building a two story foundry 50 ft. by 250 ft., on the site of Canada Electro Foundries which was de-
-oyed by fire some time ago. Mr. W.
Burrows the manager states that
have his new plant in oper-
middle of April. He is
l castings, including
ne mining and con-
is equipment will in-
c, three phase furnaces
type with Volta attach-
g a daily capacity of eigh-

The Smith Foundry Co., Fredericton, N. B., report that all through the depression their plant had been running to normal capacity and that at the present time they are enjoying one of the largest foundry and building trades in their history and are not looking for any falling off in their bus'ness.

* * * *

The Pease Foundry, Brampton, Ont., was badly damaged by fire on February 24th. Superintendent J. Davidson, who has been in charge of the plant for some time estimates the damage at $150,000, most of which was in the machine shop and store room. The foundry proper, and the pattern vault were not damaged. Reconstructoin will begin at once.

* * * *

The National Brass and Aluminum Foundry, 115-117 St. Patrick Street, Toronto, have just shipped four bronze castings, each weighing eight hundred pounds, to Niagara Falls. The manager reports that business is quite satisfactory. They are getting business, but they do not sit and wait for it to come in.

* * * *

A. J. Hamilton, Pattern Works, 120 Adelaide Street, West, Toronto, has been considerably enlarged and five additional benches installed. Mr. Hamilton, the manager, reports that business has been brisk for some time, but that at present it is not quite so busy. The automobile industry which has been experiencing something of a boom, has been creating quite a demand for patterns.

* * * *

The Amherst Foundry Co., Amherst, N. S., at their annual meeting, a few days ago were pleased to show that despite the depression of the last twelve months, there was a small balance to good after paying all expenses. This was considered a very creditable showing. During January the firm's business exceeded that of the same month last year.

* * * *

Wm. A. Rogers, Company, who operate silver plating and bronze founding business at 570 King St., W., Toronto, reported that they have had a very successful season, particularly in statuary and tablet work. A short time ago they cast a life sized statue in sterling silver. They have at present a number of good orders under way and anticipate, that orders will continue in sufficient number to keep them running at normal capacity.

The International Harvester Co., Hamilton, Ont., is negotiating for the purchase of the plant La Machine Agricole de Montmagny, Montmagny, Quebec. It is expected that the deal will be put through in a few days. The International Harvester Co., has no fear for the future.

* * * *

The Canada Foundries and Forgings, at their annual meeting which was held at their office, Brockville, Ont., on Feb. 28, elected Mr. Harry B. Housser of Toronto as a director to replace Hon. W. J. Shaughnessey of Montreal who retired voluntarily. Mr. Housser is connected with an influential financial house in Toronto.

* * * *

Electro-Castings, Limited, Collingwood, expect to have their foundry ready for operations early in April. W. T. Stephens, manager, is supervising the installation of a two-ton electric furnace of his own design. It will have a capacity of 12 heats in twenty-four hours. Production along general and special lines, will be in grey iron, hard iron and semi-steel. Mr. Stephens has had experience with electric furnaces. He was formerly with the Canada Electric Castings, Limited, Orillia, and operated a foundry for Wm. Kennedy & Sons, Owen Sound, in the building now occupied by the new company. He is assured of an abundance of power, and given that he declares the prospect to be very encouraging.

Canada leads the world in the production of cobalt, but it is to a great extent controlled by American capital. A strange coincidence is the fact that the only cobalt oxide mine in the United States that at Frederickton, Mo., is controlled by Canadian capital.

FOUNDRY LETTER BOX

Continued from page 40

I just simply liked it from the first. I think it is the most interesting trade there is. I received molder's pay after the first year and was doing all right, but am sorry to say that things have been slack for quite a while. Out of twenty-five molders only seven are working and being one of the younger men I was let go last August. Should you happen to know of anyone wanting a bench molder I would be very thankful if you would let me know."

Sincerely yours
G. Blackman,
St. Marys, Ont.

Some of The Economic Minerals of Canada

Some Figures of Production Taken from the "Preliminary Report on the Mineral Production of Canada During the Year 1920"

By WYATT MALCOLM

IN the last few issues we have shown some of the economic minerals of Canada, in some of which we lead the world. In the present issue we will show those which are of most particular interest to foundrymen.

Coal

Canada has large reserves of coal. In 1913 an estimate of the coal resources was made for the large work "The coal resources of the world," published in connection with the Twelfth International Geological Congress, and the reserve was placed at 1,234,269 million metric tons in seams 1 foot or more thick. Since that time further explorations have added considerably to the known coal areas of the Dominion.

Some of the most important coal fields that are now being operated lie on the sea coast in Nova Scotia and British Columbia—the extreme eastern and western provinces—in localities very favorable for the establishment of manufacturing industries. Extensive metallurgical plants in both these provinces use coke made from domestic coal.

Thin seams of bituminous coal are mined in New Brunswick. Saskatchewan has lignite beds of considerable extent, and Alberta has immense resources in lignite and bituminous coal. Anthracite coal also is found in western Alberta and northern British Columbia, and a small quantity is mined in Alberta. The provinces of Ontario and Quebec, the two most populous provinces of Canada, unfortunately have no coal fields and draw the greater part of their fuel supply for power and heating purposes from the United States.

The coal seams of Nova Scotia and New Brunswick occur in geological formations of Carboniferous age and those of Saskatchewan, Alberta and British Columbia in Tertiary and Cretaceous formations, most of them being of Cretaceous age.

On account of the great amount of lignite found in Alberta and Saskatchewan the prairie provinces are much interested in investigations that have for their aim a better method of utilizing this kind of fuel. An experiment in the carbonizing and briquetting of lignite on a commercial scale is now being made by the Federal Goverment, and the local legislatures of Manitoba and Saskatchewan. The outcome may lead in time to a large part of the fuel supply of Manitoba and Saskatchewan being drawn from the lignite beds of southern Saskatchewan.

Alberta, Nova Scotia and British Columbia are the important coal producing provinces, Alberta now holding the first place.

Production by Provinces in 1920

	Tons	Value
Nova Scotia	6,395,545	$28,379,653
New Brunswick ..	161,164	936,282
Saskatchewan ...	349,860	832,383
Alberta	6,859,346	30,147,466
British Columbia.	2,856,920	16,026,639
Yukon	763	4,430
Total	16,623,598	76,326,853

The growth of the coal mining industry of Canada is indicated by the following figures of production expressed in short tons (2,000 pounds.)

Year	Tons
1881	1,537,406
1891	3,527,749
1901	6,486,325
1911	11,323,388
1920	16,623,598

Iron

Iron mining and smelting from Canadian ores have been conducted on a moderate scale in Canada for over a century and a half, with interruptions. The great proportion of the ore feeding the Canadian smelters, however, is imported. The large iron and steel works of Nova Scotia are dependent on ores brought from Newfoundland where under-sea mining operations are carried on in one of the largest iron deposits of the world. The smelters of Ontario draw their supply from the large deposits in the United States at the head of the great lakes. In recent years a sideritic ore has been obtained from the Magpie mine of Michipicoten district, Ontario. In this district a large body of sideritic ore has been proved at the Helen mine, which was at one time worked for hematite.

A great number of bodies of magnetic iron ore are found in Ontario and Quebec, the Maritime Provinces, and British Columbia. Many of these unfortunately, carry rather a large amount of sulphur, and many are titaniferous. A number have been exploited.

Deposits of iron ore are found on the Pacific coast and efforts have been made to have a smelter erected and operated in British Columbia. The provincial government as an inducement is offering a bounty on pig iron.

Lead and Zinc

The lead and zinc minerals of Canada, common associates in ore deposits, come mainly from two mining districts in British Columbia, the Slocan and Fort Steele districts. In Slocan district the deposits consist of silver-lead-zinc ores in fissures and in replacement veins in slates, quartzites, and limestones. In Fort Steele district the ores come chiefly from the Sullivan mine. The country rocks are quartzites and argillaceous quartzites. The ore-body consisting of galena and zinc blende conforms in dip and strike with the formation, and replaces the fine-grained quartzites. Mining of lead and zinc minerals on a smaller scale is carried on in other parts of British Columbia, particularly in the Ainsworth and Windermere-Golden districts.

Much interest has been taken lately in a deposit of very rich argentiferous galena in Mayo area, Yukon. The other provinces in which lead and zinc are mined are Ontario and Quebec.

The production of lead in Canada in 1920 amounted to 33,985,974 pounds as compared with a production in 1919 of 43,827,699 pounds. The production of zinc was 40,166,200 pounds in 1920 and 32,194,707 pounds in 1919.

Copper

British Columbia is pre-eminently the copper producing province of Canada. In a total production in Canada in 1920 of over 81,155,360 pounds the yield from British Columbia was 45,344,434 pounds and from Ontario 31,980,067 pounds. The total value of the copper produced in Canada in 1920 was $14,166,479; the only metallic minerals exceeding this were nickel and gold.

The greater part of the copper ore produced in British Columbia is derived from large, low-grade deposits, the two most important mines in 1920 being at Anyox and Britannia Beach, both on the Pacific coast.

The Anyox ores consist of cupriferous pyrite, pyrrhotite, and chalcopyrite. They are contact metamorphic deposits, and occur in sedimentary rocks, mainly argillites, in which beds and bands of greenstones, probably of pyroclastic origin, are found. These rocks are surrounded, and doubtless underlain, although at considerable depth, by granitoid rocks from which heated siliceous waters carrying iron and copper sulphides in solution ascended, forming the ore-bodies. The ores carry gold and silver.

At Britannia Beach, in the southwestern part of the province, the mineralized zone is located in a belt of metamorphose sedimentary and igneous rocks which forms an inclusion in the granodiorite batholith of the Coast range. The sediments consists mainly of argillites. In these are enclosed thick tabular masses of igneous rock varying from quartz porphyry to diorite porphyrite. The ore-bodies lie almost wholly in a shear zone in which the porphyry is altered to schist. Mineralization is of the nature of impregnation and replacement of the schist by pyrite, chalcopyrite, and cupriferous pyrite, with minor amounts of zinc blende.

THE LATE SENATOR JOHN MILNE

(Continued from page 41)

In 1876 he married Miss Mary Mason, daughter of William Mason, by whom he has three sons. The widow and three sons survive him.

Senator Milne had been in failing health since October, and recently gangrene developed in one of his feet, but he was too feeble to undergo an operation.

CLASSIFIED ADVERTISEMENTS

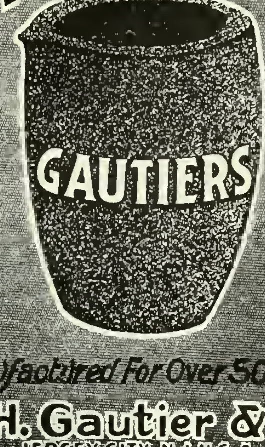
TWO CENTS A WORD, including the "Canadian Foundryman" box numbers; minimum charge is $1.00 per insertion, for 50 words or less, set in 6 point type. Each figure counts as a word. Display ads., or ads. set in border, are at card rates.

POSITION WANTED

BRASS FINISHER, GOOD ALL ROUND MAN, lathe and bench hand, plain pattern making, good knowledge of polishing and plating. At liberty April. Go anywhere. Box 704 Canadian Foundryman.

PRACTICAL FOUNDRYMAN, 25 YEARS ON light, medium, and heavy work, green and dry sand. Bench, floor and machine molding. Melt by analysis and thoroughly competent on Cupola practice. Good reference. Box 707, Canadian Foundryman. (C.3F.)

POSITION WANTED BY FOUNDRY Foreman, 25 years practical experience on Stove, Furnace, Boiler Sections, Match Plates, and Moulding Machines. Capable of figuring costs. McLain graduate, presently employed but desires change. Address Box 706 Canadian Foundryman.



CLOSING TIME

Advertisements for this section must be in our hands on the 9th of each month.

In order that the announcements of your wants, etc., shall not be delayed, please try to have them in our office as early as possible.

CANADIAN FOUNDRYMAN

FOR SALE

BARGAIN IN USED ELECTRIC FURNACE - A one-ton Volta Electric Furnace for melting steel, grey iron or Ferro alloy furnace, 220 volts, 25 cycle, 3 phase; complete equipment. For further particulars write Hiram Walker & Sons, Metal Products, Limited, Walkerville, Ont., P.O. Box 156. (c.t.f.f.)

Do you want to earn some extra money? This can be done in spare time by a man who has had good experience in foundry practice. The right man must be able to approach foundry owners and executives. If you have the right aggressiveness, you can earn as much, on the side each week as your weekly pay. If you are interested apply Box 708L, Canadian Foundryman.

Reserve space now for the Pre-Convention Number which will be published in May.

AUTOMOBILE PISTON
25% STEEL

99% Good Semi-Steel Pistons

Mr. James Arterburn, Superintendent Cream City Foundry Company, Milwaukee, Wisconsin, is making thousands of pistons using 25 per cent. steel, with casting losses and rejections less than one per cent.

Can You Duplicate This Record?

Why continue to experiment, losing 5 to 15 per cent. cylinders, pistons, piston rings, and other quality castings which should and can be made of McLain's Semi-Steel and only possible when *carbon is absorbed.*

David McLain who made it possible for Mr. Arterburn and thousands of others throughout the world to make good semi-steel for pistons and other **light** castings.

The Steel and Carbon Theory Exploded

James Arterburn, 1910 McLain Graduate, purchased Sixth Edition of McLAIN'S SYSTEM in 1920.

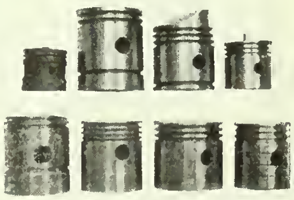
Ancient warriors forged swords from lumps of ore which were heated, hammered, reheated in crude wood fires, and rehammered innumerable times until it became wrought iron, which, absorbing carbon, from the fuel became steel from which the swords were made.

Chemists found these swords to contain 1 to 2 per cent. carbon, proving that steel will absorb carbon from the fuel, whether wood, coal or coke.

BLAZING THE TRAIL—It is a big jump from the ancients to a steel foundry in Pittsburg where David McLain learned that liquid steel would absorb carbon from coke facing sand, which discovery revolutionized metallurgy as relates to cupola melting of gray iron and semi-steel.

Mr. McLain did not patent his discovery but has taught thousands of foundrymen throughout the world the secret of making real semi-steel.

McLAIN'S SEMI-STEEL



SEMI STEEL PISTONS CONTAINING 15 TO 25% STEEL

McLAIN'S SYSTEM, Inc.

700 Goldsmith Building Milwaukee, Wis., U. S. A.

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Directory of Foundry Supply Houses

The Buyers Directory of Canadian Foundryman was originally intended to contain information regarding lines in the production of which the advertisers actually specialized. We now carry the advertising of leading supply houses, some of whom represent scores of manufacturers, in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the supply houses so we recommend that for all general requirements our subscribers communicate with the supply houses listed below:

The Hamilton Facing Mill Co., Limited, Hamilton, Ont.

George W. Kyle & Co., Inc., New York, U. S. A.

Frederic B. Stevens, Windsor, Ont.

The E. J. Woodison Company, Limited, Toronto, Ontario; Montreal, Que.

ANODES, BRASS, COPPER, NICKEL AND ZINC
W. W. Wells, Toronto, Ont.

ARGON
Dominion Oxygen Co., Toronto, Ont.

BENCH RAMMERS
I. Johnson & Son, Ltd., Toronto.

BLAST GAUGES
Clark Blast Meter Co., Gladbrook, Iowa.

BRASS FURNACES
Hawley Down Shaft Furnace Co., Easton, Pa.

CHAPLETS
Wells Pattern & Mach. Works, Toronto, Ont.

CHEMISTS
Charles C. Kawin, Chicago, Ill.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Indiana

CORE MACHINES
American Foundry Equipment Co., New York City.

CORE OVENS
Damp Bros., Mfg. Co., Toronto, Ontario.
Monarch Engineering Mfg. Co., Baltimore, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.

CORE PLATES
Damp Bros., Mfg. Co., Toronto, Ont.

CORE SAND
Benson & Patterson, Stamford, Ont.
George F. Pettinos, Philadelphia, Pa.

CRANES
Northern Crane Works, Ltd., Walkerville, Ont.

CRUCIBLES
Joseph Dixon Crucible Co., Jersey City, N. Y.
J. H. Gautier & Co, Jersey City, N. Y.

CUPOLAS
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co, Cleveland, Ohio.

CUPOLA LININGS
Whitehead Bros., Buffalo N. Y.

DUST ARRESTERS
W. W. Sly Mfg. Co, Cleveland, Ohio.

EDUCATIONALISTS
McLain's System Inc., Milwaukee, Wis.

ELECTRIC RIDDLES
Great Western Mfg. Co.
Preston Woodworking Co.

ENAMEL WARE
Crane Limited, Montreal, Que.

FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FIRE BRICK
Bailey & Bell Firebrick Co., Toronto, Ont.

FLASKS
I. Johnson & Son, Ltd., Toronto.

FLASKS, SNAP
American Foundry Equipment Co, New York City.

FLASKS, STEEL
American Foundry Equipment Co., New York City.
Sterling Wheelbarrow Co., Milwaukee, Wis.
Trussed Concrete Steel Co., Walkerville, Ont.

FLUXES, IRON, BRASS, ALUMINUM, COPPER
Basic Mineral Co., Pittsburgh, Pa.

FLUOR SPAR
Basic Mineral Co., Pittsburgh, Pa.

FOUNDRY ENGINEERS
Charles C. Kawin, Chicago, Ill.
H. M. Lane Co., Detroit, Mich.
McLain's System Inc., Milwaukee, Wis.

FURNACES, OIL
Hawley Down Draft Furnace, Easton, Pa.
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES, GAS
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES COKE
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES ELECTRIC
Volta Mfg. Co., Welland, Ont.

GRINDERS, PORTABLE
A. W. Sainsbury, Ltd.
Cleveland Pneumatic Tool Co., Cleveland, Ohio.

GRINDERS, SWINGING
A.W. Sainsbury Lt., Sheffield, England.

HEATERS
E. J. Woodison & Co., Toronto.

HEATING SUPPLIES
Crane Limited, Montreal, Que.

HOSE COUPLINGS
Cleveland Pneumatic Tool Co., Cleveland, Ohio.

INDUSTRIAL ENGINEERS
H. M. Lane Co., Detroit, Mich.

KAOLIN
Whitehead Bros., Buffalo N. Y.

LADLES
Damp Bros., Mfg. Co., Toronto, Ont.

LADLE SHANKS
Damp Bros., Mfg. Co., Toronto, Ont.

MAGNETS
Dings Magnetic Separator Co., Milwaukee, Wis.

MAGNETIC SEPARATORS
Dings Magnetic Separator Co., Milwaukee, Wis.

MALLETS
I. Johnson & Son, Ltd., Toronto.

METALLURGISTS
McLain's System Inc., Milwaukee, Wis.
Charles C. Kawin, Chicago, Ill.

METAL PATTERNS
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Grimes Molding Machine Co., Detroit, Michigan.
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A. MacMillan, St. Catharines, Ont.
Benson & Patterson, Stamford, Ont.
Geo. F. Pettinos, Philadelphia, Pa.
Venango Sand Co., Franklyn, Pa.

OXYGEN
Dominion Oxygen Co., Toronto, Ont

PATTERN MAKERS
Bryant Pattern Works, Windsor, Ont
Hamilton Pattern Wks., Toronto, Ont
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PIG IRON
A. C. Leslie & Co., Ltd., Montreal.
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SAND
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George F. Pettinos, Philadelphia, Pa.
Venango Sand Co., Franklyn, Pa
Whitehead Bros., Buffalo N. Y.

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American Foundry Equipment Co., New York City.

SAND MIXERS
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National Engineering Co., Chicago, Ill

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SAND MULLERS
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National Engineering Co., Chicago, Ill.

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American Foundry Equipment Co. New York City.
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Damp Bros., Mfg. Co., Toronto, Ont.

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R. MacDougall Co., Galt, Ont.
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VENT WAX
United Compound Co., Buffalo, N. Y

WASH ROOM FIXTURES
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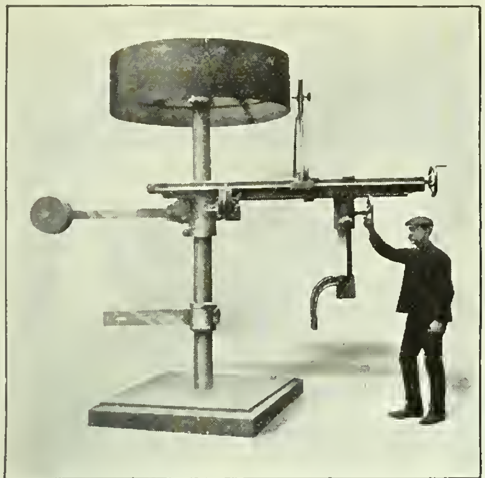
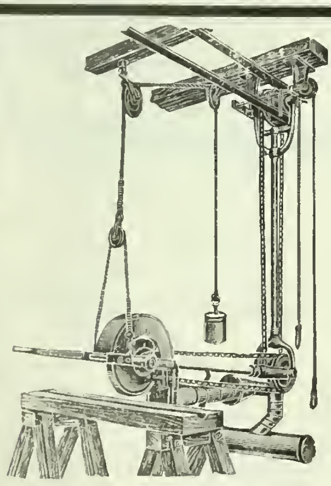
WELDING AND CUTTING SUPPLIES
Dominion Oxygen Co., Toronto, Ont.

WHEEL BARROWS
Sterling Wheelbarrow Co., Milwaukee, Wis.

Why Don't You Write?

HARDLY a week passes that Canadian Foundryman does not receive copies of this paper returned by the postal authorities because of the change in firm names or the address of some whose names are on the mailing list. Sometimes complaints reach us of the non-delivery of mail matter. It is not till the receipt of such complaints or the return of the paper, as the case may be, that we obtain any knowledge of the changes or removals of persons or firms. The adoption of the co-operative spirit on your part by notifying changes would make things a good deal more pleasant for both parties. The MacLean Publishing Co. want their mailing list to be in such shape that they will be able to render the perfect service to their subscribers. There is a lot of valuable trade matter mailed by this company and if you don't receive it—well, the fault is entirely yours.





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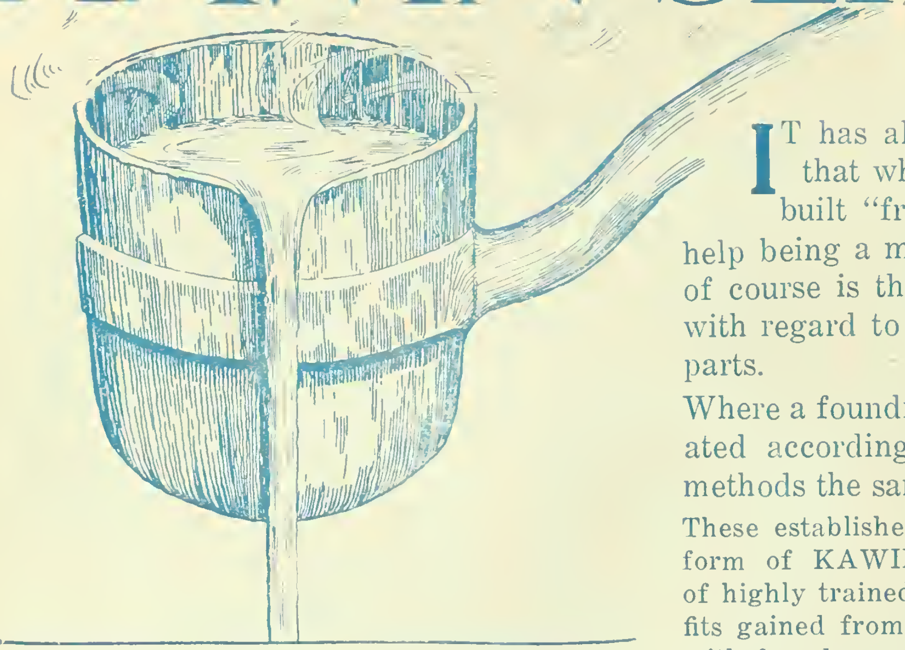
CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England.

Vol. XIII Publication Office, Toronto, April, 1922 No. 4

KAWIN SERVICE



IT has always been a logical theory that where an automobile has been built "from the ground up" it can't help being a mighty fine car. The reason of course is that every part is constructed with regard to its relationship to the other parts.

Where a foundry is planned, built and operated according to definite pre-established methods the same is bound to hold true.

These established methods you can use in the form of KAWIN SERVICE—an organization of highly trained men giving you all the benefits gained from 20 years practical experience with foundry problems of every kind.

Think what this means to your business. It means that when you want alterations or new equipment you are guided by the most approved methods known to foundry practice. It means that at all times you have expert advice on up-to-date cupola practice, on the economical purchase of raw materials, on the chemical analysis of your mixtures—in fact on every subject that may arise.

Can you afford to be without this valuable advisory service? So successful has Kawin been with other foundries that you are guaranteed a 100 per cent. saving over and above the cost of Kawin Service.

"Building from the Ground up"

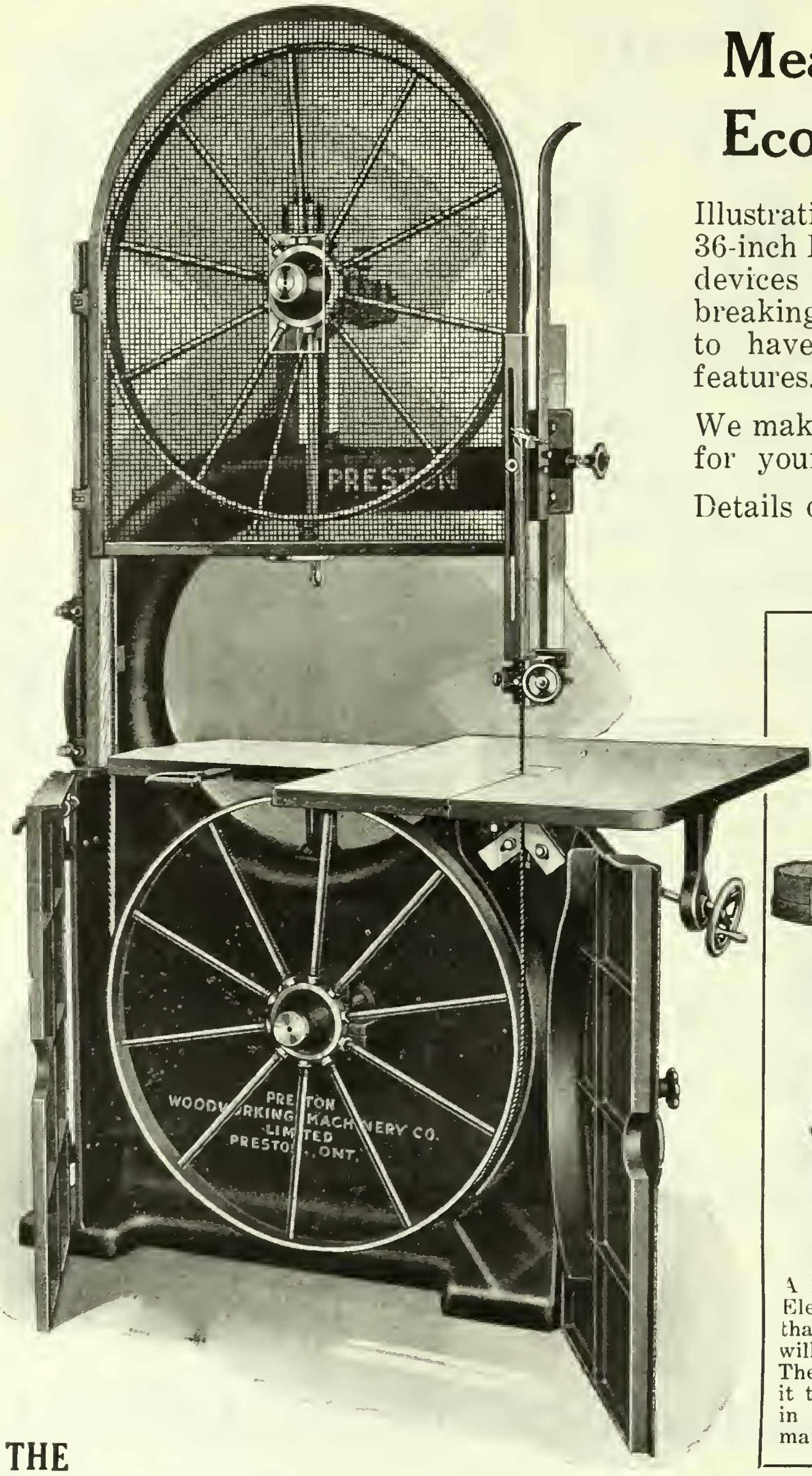
Drop us a line and we will be pleased to explain KAWIN SERVICE more fully. It will in no way obligate you.

Chas. C. Kawin
COMPANY
307 Kent Building, Toronto

Chicago, Ill   Cincinnati, O.   Buffalo, N.Y.   San Francisco, Cal.

Chemists--Metallurgists
Foundry Engineers

PRESTON Equipment



Means Better, More Economical Work

Illustration to left shows our No. 132, 36-inch Band Saw. The perfect tension devices reduce to a minimum the breaking of saws. We shall be pleased to have you investigate its special features.

We make a complete line of equipment for your carpenter or pattern shop.

Details on request.

Note This!

A 15-day free trial of our Ball Bearing Electric Sand Riddle will convince you that inside of a few months this riddle will have paid for itself.
The handy design of this riddle enables it to be used anywhere and everywhere in the foundry. It sifts faster than a man can shovel into it.

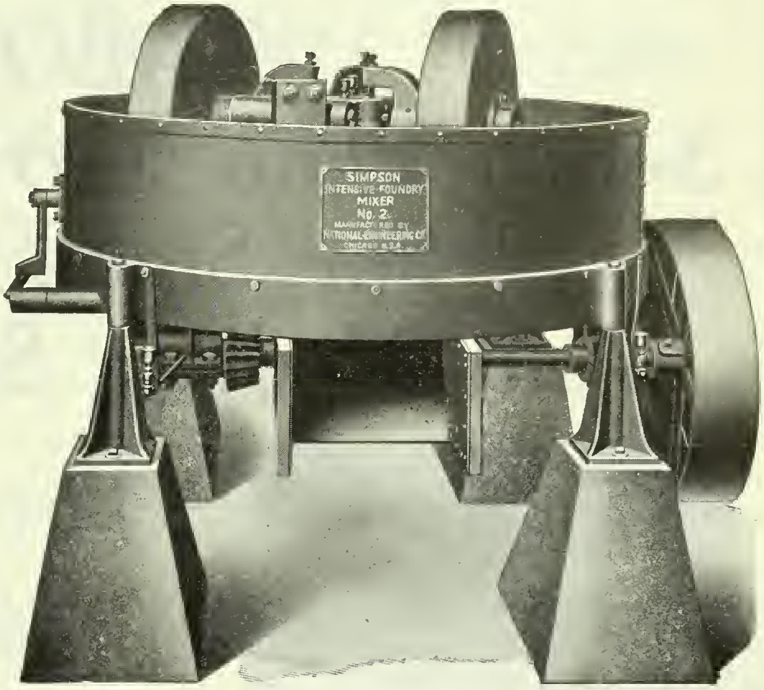
THE
PRESTON WOODWORKING MACHINERY COMPANY
LIMITED

PRESTON - ONTARIO

Simpson INTENSIVE FOUNDRY MIXER

"The Product of a Practical Foundryman"

Whenever a Simpson is Used Sand Mixing Time is Shortened



Almost any foundry can make good castings in record time if they constantly use new sand and are not at all limited to labor. But it's a different matter when it comes to using old sand; especially when there are few men to do the work. Yet, difficult as this may sound, it is being accomplished every day in foundries where the SIMPSON MIXER is used. THE SIMPSON MIXER is a wonderful boon to foundrymen. It is a substitute for men and it saves 50% of sand bills—all at a small cost.

"We used a day and night crew on our old machine but have time to spare with our Simpson Mixer," say the Bay City Industrial Works. They get top-notch results on converter and ladle linings, steel facing, etc. Like scores of other foundries they feel they couldn't afford to be without a **Simpson** Mixer even at many times its cost.

The Simpson Mixer reclaims old and worn-out sand for re-use, thoroughly amalgamates all mixtures and improves the quality of all castings. It operates with small H.P. and is so staunchly constructed that expense for repairs is seldom required. Made in four sizes.

The story is told fully in circular No. 70. Let us send it to you.

Economical and Efficient for all kinds of Sand Mixtures in Foundries Producing Steel, Grey Iron, Malleable, Brass and Aluminum Castings

NATIONAL ENGINEERING CO.

549 W. Washington Blvd. CHICAGO, ILL.

Valuable Sand Riddle Pamphlet —Free!

Mail the Coupon To-Day!

What the Pamphlet Deals With

It tells clearly why a Sand Riddle in order to be really efficient should be **portable,** have large **capacity,** be **convenient** to operate. It tells how the **gyratory motion** of the Comb's Riddle lessens repair bills; how its method of operation cuts the cost of making castings.

Before considering a riddle of any kind, every foundryman should get and read this pamphlet.

QUEBEC AGENTS

Dominion Foundry Supply Co., 185 Wellington St., Montreal.
Mussens, Limited, 211 McGill St., Montreal.
Factory Supplies, Limited, 244 Lemoine St., Montreal.
Williams & Wilson, 84 Inspector St., Montreal.
E. J. Woodison Co., Montreal.

ONTARIO AGENTS

E. J. Woodison Co., Toronto.
Hamilton Facing Mill Co., Hamilton.
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Strong Scott Mfg. Co., Winnipeg, Man.

Fill in, clip and mail this Request Form to the nearest of these agents.

The Nearest Agent for THE COMB'S Gyratory Riddle

Gentlemen:—

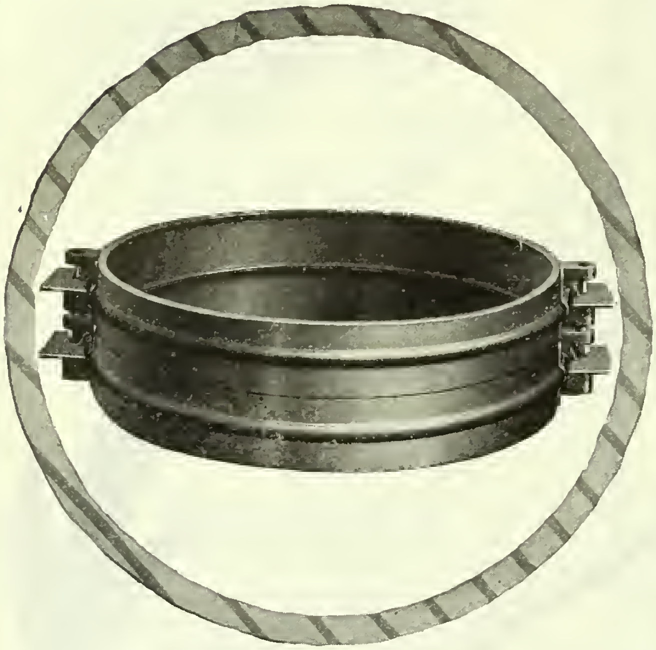
Kindly send me by return mail FREE PAMPHLET telling why the Comb's Riddle is especially adaptable to my business.

NAME ....

FIRM NAME ....

ADDRESS ....

Why Over 3000 of the 5500 U. S. Foundries Use Sterling Flasks



Sterling Rolled Steel Flask B, suitable for either bench, floor or machine moulding.

Sterling Flasks are always custom made to meet particular needs of every type of work. There are no standard sizes. Write to us outlining your requirements.

The Only Rolled Steel Flask

This almost universal adoption of Sterling Flasks is largely due to their ***rolled*** steel construction which makes a flask 50 per cent lighter than cast iron and one which can't burn nor break.

Rolled steel is the ideal flask material, combining great strength and rigidity with light weight.

And only rolled steel permits of a narrow sand retaining flange—this is why you can ram the sand even and close to the parting with Sterlings.

The Solid Center Rib

Only Sterling ***Rolled*** Steel Flasks have this great feature. It means rigidity—great resistance to torsional strains and stresses. It brings these advantages without increasing weight.

This solid center rib is an integral part of Sterling Flasks.

The Angle Reinforcement

Large size flasks need additional reinforcement. This fact everyone concedes. Even the Sterling Solid Center Rib is not enough for the big ones. But with the angle reinforcement—ah! that's another story.

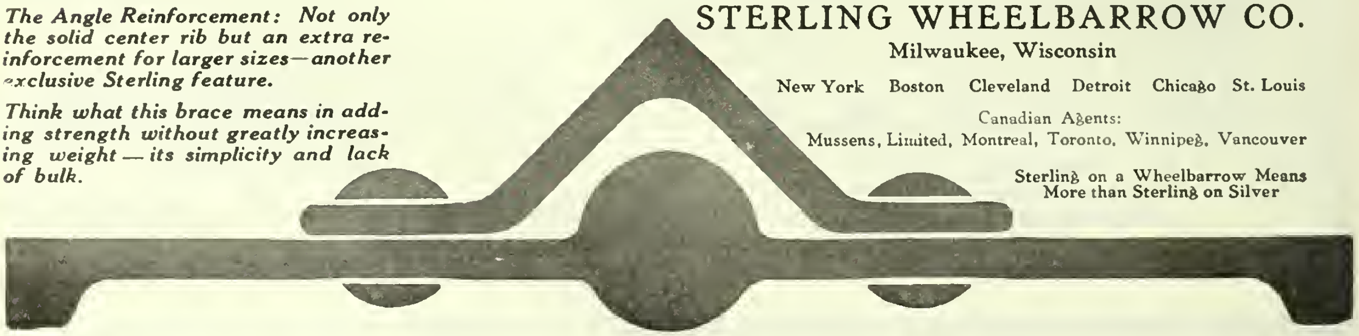
There's no job too tough for it. And note this great advantage—it does its job of reinforcing without adding great bulk or weight. A big factor in ease of handling.

Have you gone to the bottom of this flask business? Do you know that most foundries find it far cheaper to buy Sterlings than to make their own wooden or cast iron flasks?

Why not consult with us? No obligation. If you are one of the few who cannot profitably employ Sterlings, we'll tell you quick enough. But if you belong to the great majority who can save with Sterlings, you should know it. Write us today.

The Angle Reinforcement: Not only the solid center rib but an extra reinforcement for larger sizes—another exclusive Sterling feature.

Think what this brace means in adding strength without greatly increasing weight—its simplicity and lack of bulk.



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Sterling on a Wheelbarrow Means More than Sterling on Silver

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Member of the "Audit Bureau of Circulations"

Established 1909
Published Monthly

Hiram Walker & Sons New Special Alloy Foundry

Plant Specially Designed for the Production of Nickelroy, Chromel, Monel Metal, etc.—Some Data on Nickel and Chromium, Nickel Steel and Rustless Iron

IN the last issue of Canadian Foundryman there appeared an article on the new foundry of the Hiram Walker & Sons Metal Products Co. of Walkerville, Ont. In this article it was shown that the site of the new plant was that which had been occupied by their special alloy foundry and that the latter foundry had to find quarters in new buildings on the opposite side of the street. This company manufacture not only their well known resistance wire, but also do a general foundry business in special alloys as well as grey iron castings. Their two special alloys are known as "Nickelroy" and "Chromel." These names introduce themselves—the one has a nickel base while the other has chrome as its important ingredient. They also make monel metal castings.

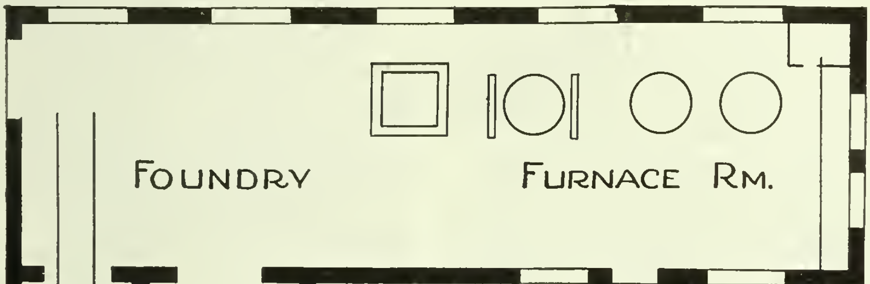
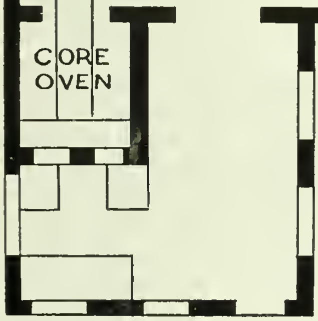



Fig. 1.—General lay-out of foundry.

The new plant for this is located on the same property on which the wire mill is situated, and as has already been mentioned, is across the street from their motor casting plant, which is known as the grey-iron division.

The general arrangement of the foundry building is shown in Fig. 1. The main foundry is spanned by a hand-operated crane with sufficient capacity to handle the furnaces or castings of considerable weight. The melting equipment consists of a tilting steel furnace of the "Harvey" type, which is shown in the foreground in Fig. 2. There are three other furnaces, which were not included in the picture, two of the pit type and one electric resistance furnace. At the back of the foundry, as shown in Fig. 2, some tracks cross the floor in connection with the core oven shown in Fig. 3. The core oven really consists of two parts—the front part with the large swing doors as shown is arranged for a car to take dry sand molds or large cores. At the back end of the oven there is a series of doors connecting directly with racks on the interior of the oven on which small cores can be baked. The oven is fired from a pit beneath the core-room floor; in fact partly under the core-maker's bench which is shown in Fig. 4. With this arrangement the light cores, as made, are put directly into the oven; the core-maker only having to make one or two steps.

In the space at the left of the core-oven as shown in Fig. 3, are situated the gyratory riddle, a Wadsworth facing mill, a double emery grinder, and a positive pressure blower for supplying blast for the oil-fired furnace. This arrangement gives a compact little foundry which at the same time is capable of turning out castings of considerable weight, or a considerable number of small castings, and while it is not large it is able to take care of any demand for special alloy castings arising in the Canadian trade.

These special alloys make an interesting study, and while there are many new alloys coming onto the market, all of which have advantages over the old reliable iron and brass castings for special lines of work, the most of them are made from metals which fuse at a low temperature, or in other words, which are easy to melt. Those containing nickel and chromium are, however, not in this class, but on the contrary are harder to melt than iron. Canada leads the world in the production of nickel and this should liven up interest in this metal. Nickel while a non-ferrous metal mixes readily with either ferrous or

Fig. 2.—General view of interior of foundry, showing melting furnaces.

Fig. 3.—Core oven at back of foundry.

non-ferrous alloys. Its principal use for some years back has been that of toughening and hardening steel. It is also used in conjunction with copper in the production of monel metal.

Chromium is rather a rare metal, but this has been chiefly on account of its being little in demand. It has of late been figuring prominently in the metal field in producing rustless iron and stainless steel. Much excitement is being created in Great Britain and the United States over the possibilities of this material.

It has proved its worth in many ways but its field of usefulness is only beginning to be recognized. However the Hiram Walker & Sons Metal Products Co. are on the ground floor and evidently intend to keep abreast of the times no matter what developments come to light. Their new foundry with its oil burning tilting furnace, electric furnace, and numerous pit furnaces, together with buildings and equipment designed and constructed with the last word in engineering skill, shows the extent to which Canadian industries, particularly the foundry, which is really the first stepping stone in all industry, are being evolved.

The rearrangement work on this latest addition to the Hiram Walker & Sons, Metal Products Co's. industries was done under the direction of the H. M. Lane Company, Industrial Engineers, with offices in Detroit, Michigan and Windsor, Ont.

THE METALS AND THEIR CHEMICAL SYMBOLS

Among the most important elements are the metals of the earth. In chemistry the meta s play a most important part and each one has a chemical symbol or abbreviation, but unfortunately for the average layman these symbols are unintelligible for the reason that they are abbreviations of the Latin names for the metals, which in some cases are retained by the English but not in all cases. For instance, Antimony is known in chemistry as Sb, because in Latin it was Stibium. Gold is Au because it was known as Aurum. Silver is Ag because it was formerly Argentum. Tungsten is W because it used to be known as Wolfram. Mercury or Quicksilver as it is sometimes known is symbolized Hg because in Latin it was Hychargyrum. Sodium is Na and was formerly Natrium. Now to get down to the more familiar metals Cu stands for copper because it was formerly known as Cuprum, and when we read of cupro alloys we know that they have a copper base. Fe stands for Ferum the Latin name for iron, and mixtures with an iron base are known as ferrus or ferro alloys. Thus ferro silicon is iron with a high percentage of silicon and ferro manganese is iron carrying a high percentage of mangenese, while a non-ferrous composition is one which contains no iron. The expression "non-ferrous" is of less import now than formerly, as it was always considered that iron and copper could not be mixed successfully, and as a consequence if it was a cupro or copper-base mixture, it must of necesity be non-ferrous (containing no iron). It is now known that iron would mix readily with copper were it not for the fact that all iron contains carbon, and copper will not mix with carbon. The introduction of aluminum into a crucible of melted copper and melted iron will remove the carbon and carry it to the surface where it can be skimmed off, after which the copper and iron and whatever other metals are in the crucible can be mixed. Many useful alloys are now made from copper base mixtures with a small amount of iron included. The introduction of aluminum while being beneficial in this respect, has also an injurious effect, and while the alloy has good strength and wearing qualities it is apt to be porous and is not suitable for castings which will be called upon to stand pressure. However, iron is being mixed with copper alloys, and as a consequence "non-ferrous" is sometimes being used in referring to mixtures which in reality contain a certain amount of iron.

Fig. 4.—Core makers' bench, back of core oven.

CANADA HAS THE MINES

In the course of his address before the Canadian Institute of Mining and Metallurgy, Mr. C. D. Corless, president of the institute, referred to the tremendous coal reserves in Canada, estimated at one thousand, two hundred and thirty-four billions of tons, or thirty-five thousand times the present annual consumption. He pointed out that although Canada was spoken of as an agricultural country only 15 per cent. of the area of the Dominion was suitable for cultivation while 90 per cent. would undoubtedly produce great mineral wealth.

Preparing Sand for Auto Castings

A Thorough Mixing Method Adapted to the Core and Facing Sand is Responsible for the Production of Better Castings and a Marked Saving in Labor and Material

PROPER preparation and conditioning of sand in the foundry constitutes one of the most important steps in the process of producing perfect castings at low operating expense. Unless the sand is in proper condition to give the mold and core the necessary degree of strength and porosity, care exercised in other parts of the work is wasted and the resulting casting will be defective. This phase of foundry practice is worthy of the earnest attention of any foundry manager or superintendent. It may be regarded as a prime essential in economical operation and one that will yield gratifying returns if given the consideration which its importance warrants. This question has been solved in a satisfactory manner at the plant of the Packard Motor Car Company, Detroit, where the rigid specification to which automotive castings must conform, combined with the necessity for economical production rendered the problem of serious proportions. Approximately 75 tons of core sand and 80 tons of dry sand facing are handled daily when the shop is working to capacity. The direct saving in labor cost on this quantity, comparing hand methods with the present method of machine mixing, amounts to a considerable item. No direct records are available illustrating the scrap loss directly traceable to improperly tempered sand under the former method of hand mixing, but the management is of the opinion that it amounted to a considerable percentage of the total.

New sand for molds and cores is unloaded from the railroad cars by a locomotive crane equipped with a grab bucket. It is dropped through hatch ways in the roof over the sand bins located on the opposite side of a covered roadway from one of the side walls of the foundry building. Wheel-barrows and electric trucks are employed to move it as required from the bins to the respective sand mixers. After it has been mixed according to a definite formula which embraces time as well as materials, it is moved by the same agency to the individual workmen's benches or machines.

The core sand is mixed in a 6-foot Simpson pan made by the National Engineering Co., Chicago, equipped with a bucket loader operated by a clutch connection on the shaft of the mixer. The bucket is designed to hold the maximum amount that can be handled in the pan at one time and it is claimed that this feature saves considerable time and also insures a more uniform mixture. It removes the hazard of forgetfulness always present when the matter of counting the measures, shovel or bucketful and binder is left to the discretion of the operator. Another advantage claimed for this method is that since a sufficient quantity of material for a batch is dumped into the pan at one time and then milled for a definite period, the entire quantity will be uniform.

Mixed Not Crushed

To provide a free vent in the cores it is essential that the individual grains of sand should not be crushed and it has been found by experiment that the desired result can be accomplished by allowing the pan to revolve for two minutes. It also is stated that the combined plowing and mulling action of the rollers thoroughly incorporates the binder so that each grain is covered with a film of oil, in the same time.

Some interesting figures are submitted in this connection. For instance, where formerly the core sand required the services of 5 men and cost $0.50 a ton it now is prepared by two men, wheeled in and delivered to the core makers for $0.25 a ton. Formerly oil in the proportion of 1 to 60 was required to give the cores the necessary strength. This has been reduced to a ratio of 1 to 70. Based on a daily consumption of 75 tons, the saving by this method of mixing amounts to $18.75 a day. Facing sand for dry sand cylinder molds is prepared in another mixer of the same make, also equipped with a bucket loader. This practice has been adopted as the result of experience which shows that the composition of the sand and the manner in which it is mixed determine to a considerable extent whether the castings produced go to the machine shop or the scrap pile. The same factors also determine whether the skin of the casting peels clean or presents a rough and dirty appearance.

The present method of mixing the dry sand facing has resulted in reducing the amount of new sand required by about 50 per cent. Also with fewer men it is possible to keep from 1 to 2 hours' supply of facing always ready ahead of requirements. While the Packard practice is not based on the claim that all automobile cylinders should be made in dry sand molds, comparative costs indicate that under certain conditions and where a definite standard of appearance is reckoned as a factor, dry sand molds are preferred.

With the facing sand, also, it has been found that a 2-minute mixing period yields a satisfactory composition. The necessary bond is furnished by sprinkling in each batch while in the pan with a water soluble binder. It has been the experience of the Packard Co., that dry sand molding involves little more expense than green sand on this particular job and this expense is more than offset by the advantages of the method. It is an insurance against cuts, scabs, blows, drops, hard spots and eliminates the use of chaplets. After the mold is dried. the cores are set in and pasted and then the mold is placed back in the oven until the paste has hardened.

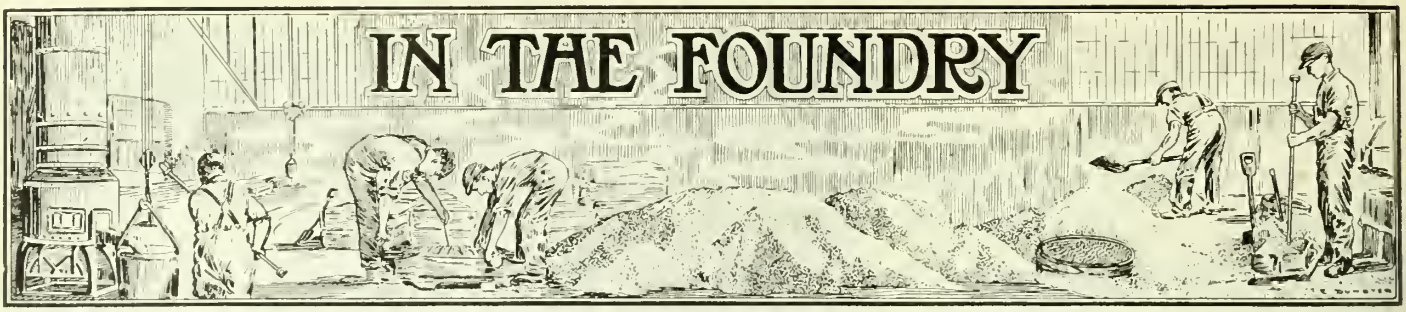
Comparative costs indicate that where formerly four men were employed to mix dry sand facing at a cost of $0.40 a ton delivered to the molding machines, two men now handle all the material and this factor added to the reduction in the amount of new sand necessary has lowered the cost of preparing the facing sand to be delivered to the molders to $0.20 a ton. Under the hand mixing method new and old sand were used in the proportion of 50 per cent. of each. Under the present method it has been found that new sand, 20 per cent. and old sand 80 per cent. makes a satisfactory mixture. From the foregoing it is apparent that the saving effected on facing sand amounts to $16.00 a day and in both core and facing sand it amounts to $34.75.

Exclusive of the cylinders, all the remaining castings are made in green sand molds. In some cases this also means that the cores are made in green sand and in other instances only the bottom half of the core is made in dry sand, the other half being blocked or topped in green sand. Many of these castings are made in molds where the pattern is covered with a regular green sand facing containing coal dust in the proportion of about 1 to 10. On others, no coal dust is required. All the green sand facing, whether containing coal dust or not is mixed in a 4-foot pan equipped with a bucket loader, made by the National Engineering Co.

The clutch housing shown in the right foreground of Fig. 4 and the aluminum crankcase shown immediately back of it are examples of castings in which both mold and cores were made in green sand without the addition of the coal dust facing.

SOLDER FOR ALUMINUM

A Solder used extensively for aluminum is composed of the following:—Tin, 63 per cent.; zinc, 31 per cent.; aluminum, 3 per cent.; phosphor tin, 3 per cent. The phosphor tin should contain 5 per cent. phosphorus.



Pouring a Manganese Bronze Propeller Wheel

Light, Strong, Rigid Metal Which Does Not Corrode From Contact With Salt Water is Required. Air Furnaces Are Used to Melt the Metal

By WESLEY J. LAMBERT

THE modern high-class marine propeller, as produced to-day by the few firms specializing in this class of work, is recognized by marine engineers who are competent to pass an opinion, to be an engineering product the manufacture of which demands considerable technical knowledge and skill. Apart from the actual design and supervision during manufacture, the best talent of the pattern maker, the moulder, and the mechanic, is requisite to ensure the production of a high-class propeller. By careful foundry manipulation and metallurgical control during the melting and casting operations, almost complete homogenity, in the sense of freedom from blow-holes and cavities, is assured, and, by subsequent judicious thermal treatment of the casting, the internal stresses are reduced, thus making the propeller as far as possible immune from failure under normal conditions of service.

A solid-propeller casting if produced under the above conditions and finished ready for service—the faces planed to the specified pitch and the backs chipped and filed; the blade scantlings correct; the contour accurately cut, and the edges, boss, and fillets filed to correct shape; the ends of the boss faced square; the boss taper-bored concentric and lapped to gauge; the keyways accurately machined; the propeller delicately balanced and hand polished, and fitted complete with gland rings and polished cone cap—may indeed claim to be considered an engineering product of excellence.

It is a matter of history that the British Admiralty, following the adoption of high-tension manganese-bronze by the principal shipowners of Great Britain, decided, after a series of trials, that henceforth all propellers for the government service should be manufactured of manganese-bronze; and at the same time introduced the Admiralty specification requiring tests not hitherto attainable by the use of the older and well established "Admiralty gun-metal."

The high-tension bronzes—as represented by those alloys having a copper-zinc basis compounded with small percentages of other metals such as manganese, tin, iron, aluminum, nickel, etc., and commonly known as manganese-bronze—constitute the series of alloys from which the majority of high-class propellers are manufactured. But two other non-ferrous metals, in addition to "Admiralty gun metal," are used occasionally for the founding of propellers, namely, aluminum-bronze, and Monel metal. The former has a copper-aluminum basis, the latter a copper-nickel.

Aluminum-bronze, although rarely used, has found a certain amount of favor with some shipowners; but its use has necessarily been very restricted on account of its relatively high cost and of the difficulties attending the successful founding of the metal. Monel-metal—so named after Dr. Monel, of the Nickel Corporation of Canada—is smelted direct from the ore, and has been employed in the manufacture of propellers for a limited number of ships in the United States navy; but so far as the writer is aware, Monel-metal has not been proved to possess any material advantages as a propeller metal.

Manganese-bronze, as previously stated, is a copper-zinc alloy compounded with varying small percentages of other metals, and therefore more truly belongs to the series of alloys called "brass." High-tension brass is the designation actually given in the British Admiralty specifications, and one must perforce admit the correctness of the nomenclature, limiting the term "bronze" as applied originally to those alloys having a copper-tin basis. However, the name manganese-bronze has become so established by long usage, that throughout this paper the names "high-tension brass," "high-tension bronze" and "manganese-bronze" will be synomymous.

Many valuable papers on the subject of the complete brasses have been read before the members of the various societies and institutions interested in the properties and applications of such alloys. Much also has been contributed to the technical magazines and papers circulating among engineers and designers; but as regards these contributions, it is feared that too often the writers of the articles have erroneously credited their readers with having a very advanced knowledge of physico-metallurgy.

The industrial "brasses" may be divided conveniently into three categories, according to the micro-structure of the metal as observed on the polished and suitably etched surface of a small specimen of the alloy. These three categories, or phases, are named respectively alpha structure, alpha+beta structure, and beta structure. In the normal condition as cast, those brasses having the alpha structure represent the weaker alloys, while the beta structure represents the alloys of the greatest tensile strength; the alpha+beta structure is associated with the alloys of an intermediate strength between those of the alpha and of the beta structures.

Viewed under the microscope with vertical illumination a polished and etched specimen of brass of either the alpha phase or of the beta phase is seen to be homogeneous, and one can observe only the boundaries of the individual grains and the light and dark effects of the light-rays reflected from the more or less acid-etched facets of these grains; whereas, the examination of a specimen of metal in the alpha+beta phase, not only reveals the grain-boundaries and the light and dark effects as before mentioned, but renders recognizable the fact that the grains are not homogeneous in the true sense, each facet showing the presence of two constituents, the lighter colored being the alpha, and the darker the beta.

The two photo-micrographs (Fig. 1 and Fig. 2, enlarged one hundred times, will, it is hoped, tend to remove any obscurity in the foregoing paragraph.

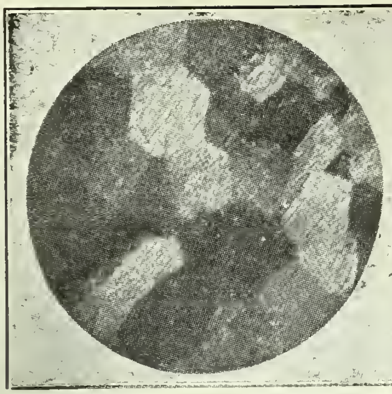


Fig. 1.—Homogeneous structure—Beta constituent.

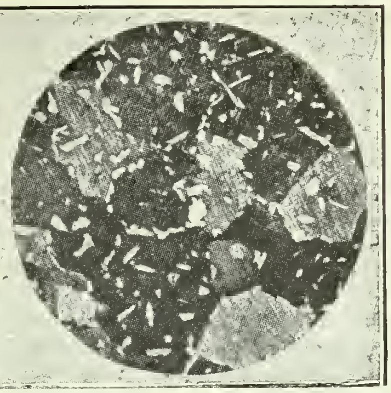


Fig. 2.—Double structure—Beta-Alpha constituents.

Only two photo-micrographs are given to avoid unnecessary confusion; and it is to be noted that, so far as ships' propellers are concerned, one's interest may be confined to the two categories of the brasses thereby represented. Alloys possessing a micro-structure of the alpha type are seldom, if ever, employed in the manufacture of marine propellers.

It is obvious upon consideration of Fig. 2 that it is possible to determine by planimetric measurement the percentage-ratio of the Alpha-constituent to the Beta-constituent; and this ratio has a considerable bearing on the ultimate strength of the alloys within the alpha-beta range. By a computation of the percentage-ratio of the two micro-constituents, an estimate may be formed of the strength of any particular alloy within this range. Speaking generally, the higher the ratio of beta-constituent, the greater the tenacity of the alloy. The type, the distribution and the occurrence of the two constituents, as also the size of the crystal grain, distinctly influence the strength, ductility, and resistance to shock and fatigue stresses of the alloy.

From the foregoing remarks, it will be apparent that the successful compounding of a high-tension bronze, as used in the manufacture of a modern high-class marine propeller, can only be accomplished through the skilful and systematic examination and control by chemical and micrographical analysis. The works laboratory should include chemical, physical, and mechanical departments. The extent to which micrographic analysis is employed in the routine examination of alloys is indicated by the statement that the laboratory apparatus includes two complete photomicrographic equipments.

The recently erected propeller department at the Charlton Works, includes the drawing-office, pattern-makers' shop, store-house, foundry, fettling, machine and finishing shops, etc., constituting the finest works wholly constructed for this speciality to be found throughout the world. Solid propellers in high-tension bronze weighing thirty tons apiece as cast can be manufactured without difficulty. The furnace, drying-stove, machine and crane capacity are designed to deal efficiently with work of this tonnage. Ample floor space in the foundry, several drying-stoves of big capacity, and a battery of large reverberatory melting-furnaces, facilitate expedition in carrying out the founding of work of this large size.

Melting The Metal

In common with all high-class castings made in manganese-bronze, the metal used for casting solid propellers and blades is remelted metal, which has been previously made and cast into ingots of 28 lbs. weight, or into billets of 10 cwts. each.

For small casts, the metal is remelted in graphite crucibles or pots, but for heavy castings the metal is remelted in large open-hearth reverberatory furnaces. The latter are specially constructed of superior refractory brickwork with a sl ping hearth or "apron," and a "well" to contain the molten metal. A tapping-hole is povided which is temporarily closed during the melting operations. A series of doors permit easy access to all parts of the furnace hearth for the charging, stirring, and inspection of the metal during the various stages of the melting operation.

Fig. 3 shows a battery of three of these large reverberatory furnaces.

For castings required to give high tests, all new metal, or a mixture of two-thirds new metal with one-third of approved scrap, e. g., heads, runners, overflows, turnings and borings, ingots of propeller bronze may be used. No scrap other than bronze of the same brand should be used in admixture with the new metal. In the case of the highest class propeller work, the total weight of metal to be charged as compared with the finished weight of the propeller should be approximately as 2:1. The weight of metal primarily charged into the furnace is dependent upon the capacity of the "apron" and the nature of the charge, whether ingot or billet metal. It is always preferable, where possible, to charge the furnace with large scrap-billets, heads, overflows, etc., because a charge composed entirely of ingots cannot be introduced except by instalments, and more time is required to melt the metal. This is due to the fact that ingots, when beginning to belt on the apron, coalesce into a solid mass and require very considerable effort to effect their dislodgement into the well. A certain amount of any casting charge is sure to be of ingots, some of which may be placed in the well, but it is always advisable to retain a certain number of ingots as "coolers" in case the furnace temperature is inclined to run hot.

When a cold furnace is to be charged entirely with ingot metal, only about fifty per cent. of the total weight should be placed upon the apron; the charging door should be closed and the furnace lighted up. The metal will gradually melt and run down into the well of the furnace. On account of the difficulty mentioned above, the ingots may require to be forced into the well by means of a crow-bar, thus leaving the apron free to receive the remaining portions of the charge, which, in small lots, should be

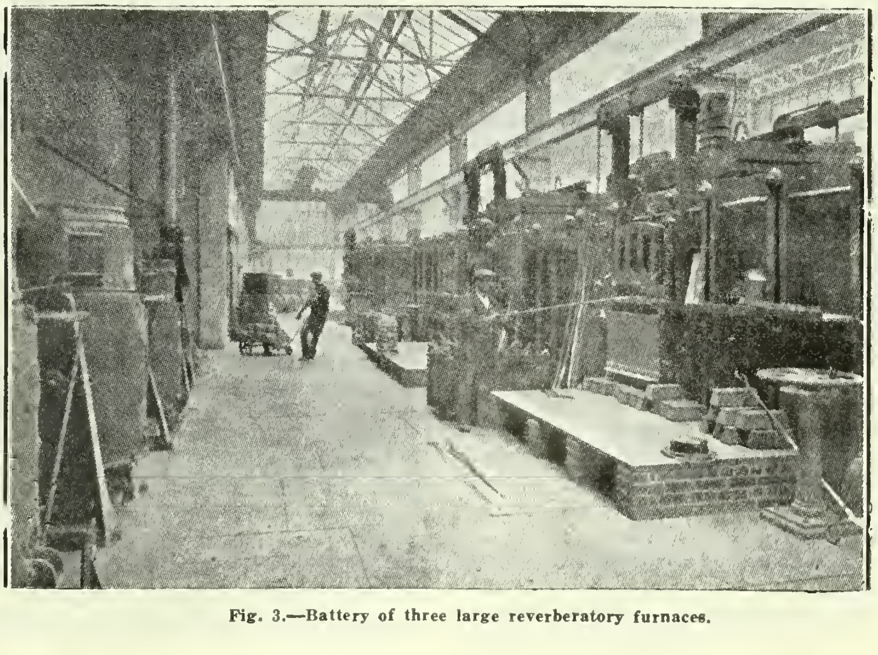


Fig. 3.—Battery of three large reverberatory furnaces.

introduced upon the apron through the "peep-holes" or smaller doors. When all the metal is melted down, the bath is ready for any final additions which may be necessary.

The temperature of the furnace must be carefully regulated to avoid excessive heating with attendant "gassing" of the metal, and also oxidation of zinc. The temperature of the bath of molten metal should, throughout the melting operations, be maintained only sufficiently above the freezing-point of the particular alloy in use as will ensure a margin of temperature for successfully carrying out the casting operation. The temperature of the bath is ascertained from time to time by the insertion of a pyrometer, after a careful rabbling of the metal.

The liquid metal, collected in the well of the furnace during the operation of melting, should not be violently or too frequently rabbled. Inattention to this point results by exposure of the uncovered metal—in a liability to the production and inclusion of oxides, and consequent alteration of the composition of the original metal. Judicious rabbling, however, is essential to ensure homogenity in the bath of liquid metal.

The total time from charging a cold furnace to the completion of melting will be from five hours to eight hours, according to the weight and form of the charge, and the working of the furnace.

Casting Operations

The operations immediately concerned with the actual casting of a solid propeller or a blade may be summarized in sequence as follows:—

(1) Pyrometric control of the metal in the furnace.
(2) Control of "zinc-equivalent."
(3) Tapping-out and skimming.
(4) Pouring the metal.
(5) Skimming the metal in the mould.
(6) Feeding.

The pyrometric control of the temperature of the metal in the furnace, more particularly when the major portion of the metal is melted is of paramount importance if high-grade castings are required. The best pyrometer is an instrument of the thermo-couple immersion type, and consists of: (a) The indicator with flexible leads and connector. (b) The stem, or thermo-couple. The indicator employed is very sensitive, although of robust construction, and is well suited for foundry use. It embodies a coil of wire moving in a magnetic field, actuated by the e. m. f. generated upon raising the temperature of the thermo-couple. To the coil is attached a needle, or pointer, which moves over a scale graduated in degrees centigrade.

The stem or thermo-couple, known in the foundry as the "stick," is composed of two thick metal wires of dissimilar composition, which are insulated throughout their lengths, except at the fire-end, where they are twisted and fused together to form a junction or couple. The insulation of the two wires throughout the length of the stick is ensured by threading porcelain sleeves upon each wire, and which if broken may be easily replaced. The whole is then enclosed in an arrangement of iron and steel tubing.

In order to determine the temperature of a bath of molten metal the fire-end of the stick is inserted into the metal to a depth sufficient to ensure that the junction is heated to the same temperature as the metal—about six inches will be found sufficient, care being taken that enough time is allowed for the junction to attain the maximum temperature of the bath of metal before the reading is taken. The wires at the free end or head of the stick are connected to the indicator by means of the flexible leads; the maximum temperature of the metal is indicated by the needle or pointer traversing the scale.

It is obvious that the operator must exercise the necessary precautions against the registration of the flame heat of the furnace gases instead of the temperature of the molten metal.

880-980 degrees centigrade may be regarded as the limits covering the range of temperature during any time the metal is in the molten condition. The temperature figure to be aimed at immediately before tapping-out the metal is naturally higher than the actual casting temperature, and depends upon variable factors, namely, (a) the freezing-point of the metal, (b) the bulk and cooling-rate of the metal, and (c) the interval between tapping the furnace and pouring the metal into the mould. The freezing-point of manganese-bronze necessarily depends upon the actual composition of the alloy, but for all practical purposes one may assume that freezing commences at about 880 degrees centigrade. The rate of cooling varies inversely as the bulk of the metal, so that a small charge requires to be tapped out at a higher temperature than a large charge.

Control of the Zinc-Equivalent

This control is highly important because of the readiness with which zinc oxidizes; and excessive furnace temperature may cause a serious diminution of the amount of this metal in the alloy.

The control is carried out in two ways, according to the type of metal in the furnace, (a) by observation of the "sparkle" to be seen upon the freshly broken surface of a fractured bar. (b) By micrographic computation of the alpha and beta percentages in such alloys as show no sparkle.

Before the metal is tapped from the furnace small ingots are cast in open-topped horizontal moulds of cast-iron. Such ingots furnish the necessary bars upon which control-determinations are made, either by visual comparison with standard fractures, or by microscopic analysis, as may be necessitated by the nature of the particular alloy.

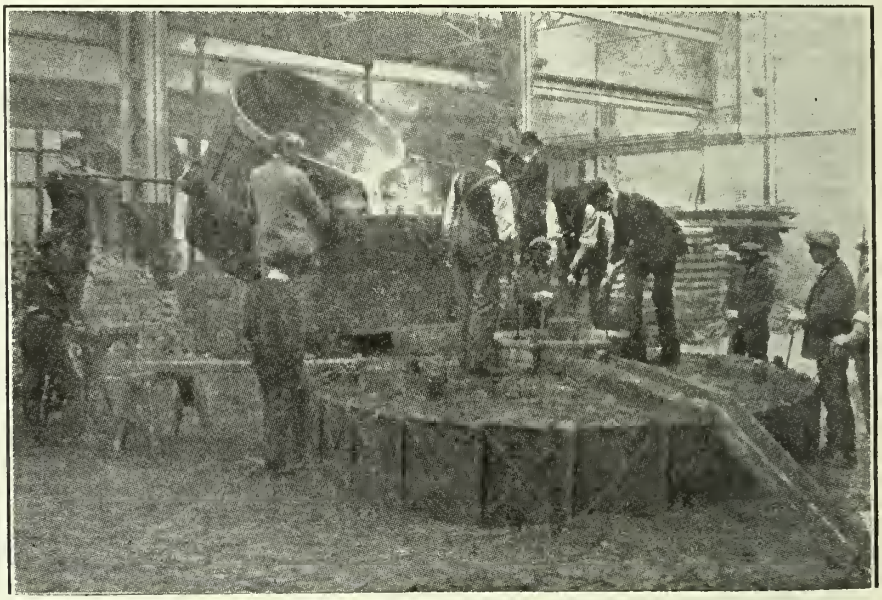


Fig. 4.—Pouring a propeller with manganese bronze.

This adjustment of the zinc-content immediately before tapping the furnace is rendered imperative, as it is obviously impossible when compounding the bronze to accurately calculate the loss of zinc occasioned on remelting the bronze in an open furnace. Such loss is dependent on (a) the period during which the metal is molten, (b) the temperature of the metal, (c) the nature of the atmosphere maintained throughout the melting operation, and (d) the exposure of the metal due to rabbling or stirring. The loss of zinc is corrected by the addition of pure spelter to the molten metal, the amount to be added being determined by an experienced metallurgist in the manner indicated.

Tapping The Furnace

The metal having been adjudged to

be correct both as regards composition and temperature, is then tapped from the furnace into a capacious ladle of sufficient size to take the whole quantity with ample margin to permit of its being safely lifted and carried by a crane to the mould. Tapping-out should never take place until it has been ascertained that everything is in readiness for the metal to be transferred from the ladle to the mould.

A "runner-box" of such dimensions as to hold about one-third of the gross weight of the casting should be in position immediately over the runner or entry to the mould, a ball-plug sufficing to temporarily seal the opening in the bottom of the box. Both the ladle and the runner-box are lined with refractory material of low thermal conductivity, and are also preheated before introducing the metal in order to guard against premature chilling of the same.

Teeming The Metal

The metal in the ladle is expeditiously and carefully skimmed free from dross by an experienced man using a heated skimming-iron, and is then carried to the runner-box and a portion of the metal transferred thereto and finally introduced into the mould by raising the ball-plug, the level of the metal in the runner-box being maintained by the addition of further metal from the ladle.

The runner-box serves a dual purpose, in that being constructed to effect bottom-pouring only clean metal is introduced into the mould, and also being raised above the highest portion of the mould, it ensures the necessary head of liquid metal to force the bronze from the bottom of the mould upwards to the top of the feeding-head above the boss in the case of a solid propeller, and above the flange when casting a single blade.

It is of great importance that the flow of metal from the runner-box to the mould should be uniform and unimpeded. Any irregularity or checking of the flow of metal is apt to cause "overlapping," that is, layers of metal solidifying independently. Care must necessarily be exercised to guard against the inclusion of dirt, dross and splashings, etc., and all such matter likely to be trapped by the casting must be carefully directed during the casting operation in such manner that it is all subsequently collected in the discard from the top of the casting.

Skimming The Metal in The Mould And Feeding The Casting

The mould, having been filled, and any surplus metal discharged, the surface of the metal in the head is skimmed free from dross, etc., by suitable skimming-irons, and the casting has then to be fed. This feeding is accomplished by one or both of the following methods, (a) use of feeding rods. (b) additions of hot liquid metal. In the former method, spoken of in foundry parlance as "pumping," heated wrought-iron rods are moved by hand up and down in the metal in the head of the casting until solidification takes place, the depth of immersion of the rods being lessened as solidification progresses. In the latter method, a liberal supply of hot liquid metal of the same quality as used in the main casting is directly mixed with the metal in the head of the casting.

Drafting Room Aids Foundry Save Defects

By Changing Design of Pattern it Can Be Molded Reverse Face Down, Thereby Insuring a Clean Face Where Required

By F. C. EDWARDS

FROM THE "Foundry Trade Journal," we extract the following story which needs no comment. If good results are expected from the foundry, this department should be considered in designing work to be done. If a casting must be of some particular shape and be perfectly clean the foundryman must bestir himself, but when an easier method is equally as good, why not make the change?

Pride of craft has, in the past, carried men on to seemingly impossible heights of attainment, and nowhere has this manifestation of real grit been more apparent than in the foundry. It is still to be found there today, and is freely exercised. There are limits, however, to its successful application, beyond which other help should be requisitioned.

A typical case of this class came before the writer some years ago. A casting was required as shown in Figs. 1 and 2, which is plan and front elevation respectively of a large press table. It

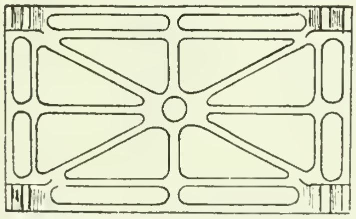


Fig. 1.—Plan of press-table ten feet long.

was essential that the bearing legs A, Fig 2, should be perfectly sound, on account of certain heavy shocks to which they would be subjected when the machine was at work. It was therefore decided to mould the job in the manner shown in Fig. 2, i.e., legs downward. This would ensure soundness of metal in the feet. Though every precaution was taken to get the top clean, subsequent machining revealed certain imperfections which caused the casting to be rejected. Obviously, if the face of the table had been cast downwards a clean surface could have been guaranteed. This desirable condition, however, would have placed in jeopardy the soundness of the bearing legs. Feeding heads were suggested, but, for certain reasons were considered inadmissible, and, in any case, the legs could not perhaps have been so implicitly depended upon as when cast downwards.

Consider, briefly, the sequence of casting this table face downwards. The metal fills the mould from below. As it rises and passes along the deep narrow spaces that form the ribs it naturally tends to become sluggish. Carrying along with it an increasing amount of sullage—some of which it gathers on its journey through the mould—it ultimately reaches the legs. Here, probably in some cases adjacent to the corners where the legs join the body of the casting, this scum finds a lodgment. The skin of the

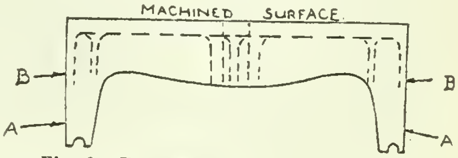


Fig. 2.—Front elevation of same casting.

casting may not reveal its presence, and it remains undetected until the load is applied; or, worse still, it remains as a potential source of future disaster owing to the cumulative effect of repeated shock. One may also expect a condition of porosity to be present in these relatively heavy legs. The difference in the rate of cooling would introduce another weakening factor, viz., the permanent internal strain set up by shrinkage stresses.

When the drafting room realised that the foundry were thus in a delemma, they immediately altered the design to one in which the bearing legs were cast separately, as shown at Fig. 3, and afterwards bolted on to machined faces, at B, B, Fig. 2. All was now plain sailing for the foundry; they could guarantee a clean surface on the top of the table, and, by casting the legs bearings downward, soundness here was also assured.

Incidentally, another advantage was secured with separate legs. If, in handling in the shops, or during transit, one of the legs was broken—which is by no means a remote contingency, with the casting in one piece—a complete table would be required to make good the damage. With legs cast separately, however, the extent of the injury would be confined to the broken leg alone, merely necessitating another leg casting.

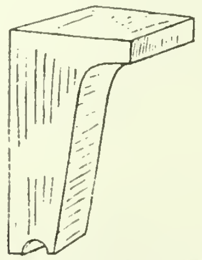


Fig. 3.—Bearing-leg cast separately.

Research Work on Zinc and Zinc Alloys

Alloys With a High Percentage of Zinc Replace Brass With Favorable Results—Pressed Zinc a Commercial Success, After Initial Difficulties Have Been Overcome

By WALLACE DENT WILLIAMS

IN THE LAST article, the results of different experiments were shown, together with the molds showing the feeding heads and other casting methods. The pouring of the zinc alloy became so systematized that very few castings were rejected and the foundrymen were able to reap good profits. In the following article will be shown the effects of introducing copper and aluminum.

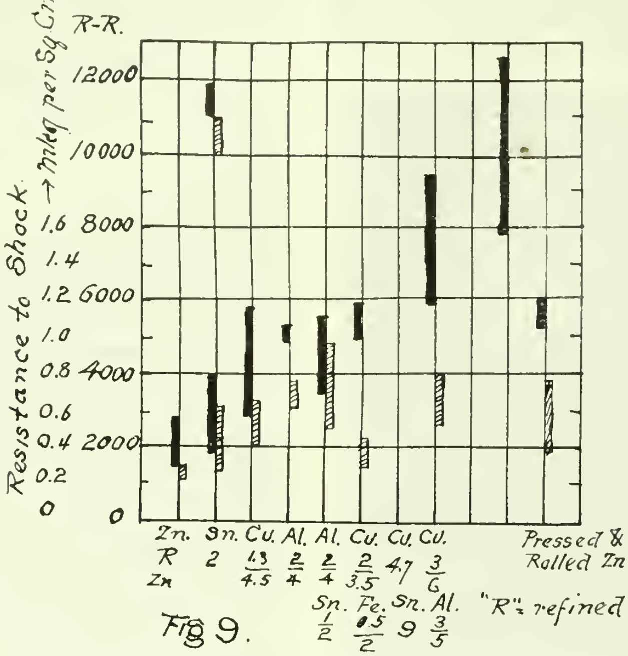


Fig. 9.—Comparison of the tenacity of zinc and zinc-alloys (Chill-cast.) The resistance to rupture (in Kg per 1000 sq. mm of the breaking cross-section) and the impact tenacity (MKg per sq.cm) represent the mean value from numerous experiments with worked bodies.

Influence of Copper and Aluminum Additions

The influence these additions had upon the resistance to rupture is shown in Figures 9 and 10. With increasing additions of copper the tenacity increased more rapidly than with the corresponding additions of aluminum, but the latter offered the pouring technique the advantage of soundness, because the danger of piping is small with alloys that contain aluminum. By means of the copper additions the grain is closed and that is surely an advantage.

Table 4 gives the tensile properties of the alloy with 5 per cent. copper, and 3 per cent. aluminum in the manufactured metal. In a measured bar cut from the cast piece, the resistance to rupture amounted to about 12 Kg. per square millimeter, or 17,068 lbs. per square inch, the shock test was proportionately good; 0.5 mkg. per square centimeter. It was similar to that of pressed zinc, in which, according to the initial tests, the stipulated minimum values were reduced to 0.45 mkg. per square centimeters, although the remaining tenacity values lie lower; a demonstration of the material difference between both kinds of requirements which will be referred to later. In general the resistance to rupture of this alloy can be accepted as follows: Tensile strength from 10 to 15 Kg. per square millimeter or 14,223 to 21,335 lbs. per square inch, the elongation is equal to 0.1 to 0.3 per cent. the hardness is from 70 to 80 (ball diam. 10 mm. and load is 300 Kg.)

The structural formation of the alloys Figs. 11 and 12 confirm the experiments of the comparative tenacities, see Fig. 10. The polished surface shows the interlacing needle shapes and clusters of combined crystals which are claimed to be copper-rich mixed crystals. As the experiments with copper-zinc alloys have stated they are the solid constituents and act in consolidating the mass while the rest of the metal presses through. As to the remainder there are still present islands of dark mixed crystals of aluminum-zinc and an aluminum-zinc eutectic. For the proper formation of the copper-rich metal, the cooling velocity, the temperature of the melt, and the (casting) mold, are influential.

The formation of the clustered needles is prevented by too rapid a cooling and therefore the copper-rich crystals assume a rounded shape, then the consolidation effect is smaller and the total tenacity of the alloy drops (hot and chill cast alloys, Figs. 13 and 14). The fractured area structure is a reliable indication of the goodness of the casting. A good cast alloy shows a medium fine grain (an alloy with a grain

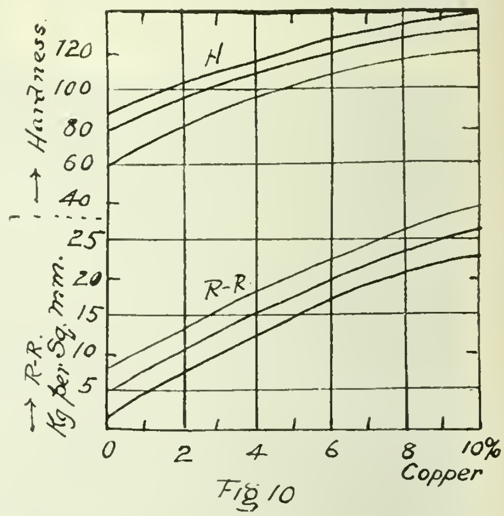


Fig. 10.—Influence of the amount of Cu in the Zn-alloys upon the tenacity and the hardness.

as fine as that of refined steel may show a high tensile strength, relatively, but it will certainly be defective in its elongation); that the fracture should show mirroring crystal surfaces with a lateral length not exceeding 1 millimeter.

It has been shown that where the copper is less than 3 per cent. and the aluminum at the same time amounting to fully 3 per cent. the effect of the consolidation by means of the cuprous needles almost wholly disappears, and even with the freezing the zinc characteristics are able to be recognized by the characteristic crystal cleavage, which naturally in an unsound structure results in a lowering of the tenacity to that of the ordinary zinc bar.

Influence of the Temperature upon the Defects of the Castings, Etc.

That the chief constituent of zinc is codeterminate also with the behavior of the alloys at different temperatures, the experiments with zinc castings have shown for those which had lain in storage for a long time. Therefore for the verification of this phenomenon, as to whether the transformation had preceded the alterations observable in the tensile properties, time experiments were made. With them it followed that

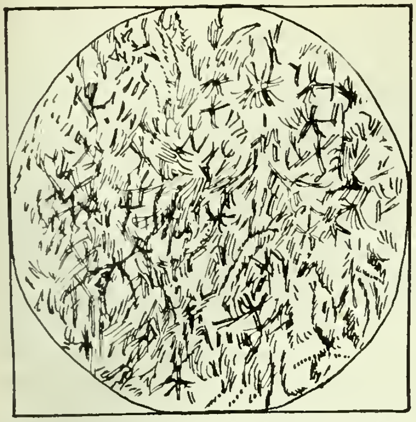


Fig. 11.—Structure of Alloy. 91 per cent. Zn+6 per cent. Cu. + 3 per cent. Al. × 18.

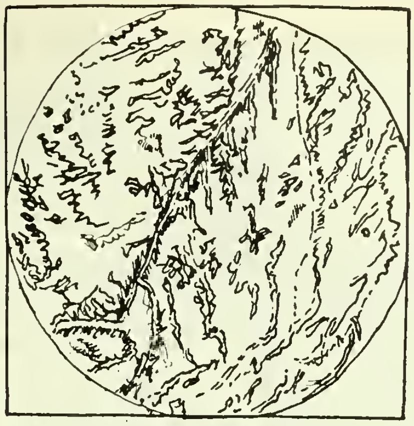


Fig. 12.—Alloy same as in Fig. 11. × 90.

the resistance to rupture was not materially influenced, but the resistance to shock, however, especially if by pouring the metal at the favorable temperature, and with the (casting) mold at the proper temperature a great falling off of its impact value was found to be connected with the amount of time the metal was kept in storage. Fig. 15 shows the drop which may be conjectured as an asymptotic approximation to a steady value of 0.3 mkg., (It will be remembered from the Feb. issue that the expression "mkg." wherever used indicates a unit of energy or of work being the amount expended in raising one kilogram through the height of one meter, in the latitude of Paris. That is one kilogram-meter is equivalent to 7,233 foot-pounds per square centimeter falling from the initial value of about 0.5 mkg. per square centimeter. The original value which was determined half a year previously and by means of a tapping sample, showed the impact value of 0.7 mkg, per square centimeter. It is not sufficient to recognize the casual changes, free from objections; it appears, however, that also the copper crystallites along with the zinc-aluminum-mixed crystals participate in the change. Where the higher temperature influences are of importance it becomes necessary therefore to calculate only the lower tenacity values.

Furthermore it is important with the use of such cast alloys from the manufactured material to enter into the calculation all the destructive influences. Thus the unavoidable mistakes in the casting temperature fluctuations of the melt, the (casting) molds, variations in the composition of the alloy, impurities in the metal especially, if chips and residues are melted together, are to be considered. By this means was brought about a wide spreading out of the tensile properties. Fig. 16 discloses in what proportion such a dispersion appears in the manufactured material. (The diagram shows in how many tests for the differences in the breaking loads the obtained values failed. It was a question of tapping tests from a supply

Table 4.

Tenacity of Castings from the Zinc-alloy.-Zn 5 Cu 3 Al.

Alloys of the Firms.	Cu %	Al %	Resistance to rupture Kg per Sq.mm.	Impact Test. MKg per Sq.cm.
A	5.5	2.7-3.1	7.5	0.55-0.96
B	5.4	".9	6.9-7.8	0.63-0.77
C	4.5-5.1	3.2-3.6	7.2-8.6	0.56-0.67
"	4.5-5.7	3.-3.6	6.3-7.95	0.57-0.69
"	4.8-5.2	3-3.7	6.6-7.9	0.66-0.94
"	5.0-5.2	3.3-3.5	7.4-8.5	0.70-0.80
"	4.9-5.1	2.9-3.5	7.2-8.0	0.71-0.80
D	--	--	5.8-7.5	0.52-0.75
E	5	3	102	0.98
F	--	--	8.27-9.78	0.72-0.94
G	4.2-4.9	2.2-2.7	5.09-7.06	0.615-0.87
H	5	2.5	5.35-6.8	0.63-0.70
J	5.2-5.6	2.5-2.8	6.75-8.5	0.82-0.11

The cross-section fracture in the worked body of 1000 sq.mm, on both sides with back-tapping. This applies to the figures in Column 4.

of 1,773 million castings. As specified the lowest value considered was 3,000 kilograms. The rupture load is given in the diagram with 1,000 square millimeters of fractured area). With this it is a question of several million worked molded bodies which must be learned exactly, therefore they must show only a small deviation from the proportions. The variations of the tenacity amount as perceived to about 50 per cent., and it is clear that with the stipulation of the safety figures for the construction this circumstance must be considered. The effect of the waste (gate) heads and of the chips upon the fusion was especially studied. It turned out, as Fig. 17 shows, that by the consideration of the precautions taken for the purification of the melt, a reduction of the tenacity need not be feared (Comparison of the tenacity of the zinc alloy, with 5 per cent. copper, also 3 per cent. aluminum with the various materials, is shown in the diagram. The rupture load is given in Kg. with 1,000 square millimeters of the fractured area). Up to 30 per cent. of new metal was therefore permitted; after all, the experience furnished by the manufactured material appeared to dispose of this caution.

Additions of Iron

Experiments with zinc-alloys with additions of iron for which, if possible, the copper should be substituted, showed no results, in which to be sure, a hardening was obtained but not sufficiently established. Under the name of "Hard Zinc" an alloy is generally known which is formed in the melting pots or kettles used for galvanizing purposes. Along with the zinc it contains several per cent. of iron. Although the tensile properties of the alloy promise no special possibilities of use for constructive parts that are subject to a pulling stress, it can, however be depended upon to resist pressure, bushings for example, can be made use of.

Higher Aluminum Additions

The prospect of an alloy with a higher value is disclosed by a composition with a greater per cent. of aluminum. From the earlier work (Bauer) it is known that with an addition of about 20 to 30 per cent of aluminum the tenacity reached the upper limit of value. Alloys with 70 per cent. zinc and 30 per cent. aluminum were therefore investigated as a special case, as a substitute for brass. The resistance to rupture was favorable for a casting alloy, the tenacity amounted to 30 Kg. per square millimeter or 42,670 lbs. per square inch, the elongation to be sure, was naturally very low, but after all, it was yet to be established. The impact tenacity proportionately was low. The structure was fine grained, showed a lustrous silver gray, steely fracture.

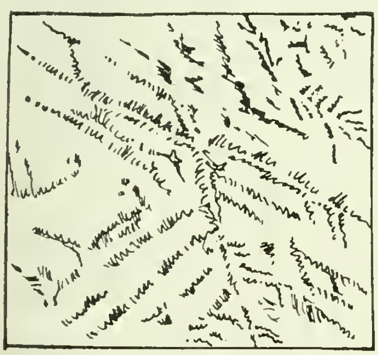


Fig. 13.—Alloy 91 per cent. Zn + 6 per cent. Cu. + 3 per cent. Al. Cast hot. 56.

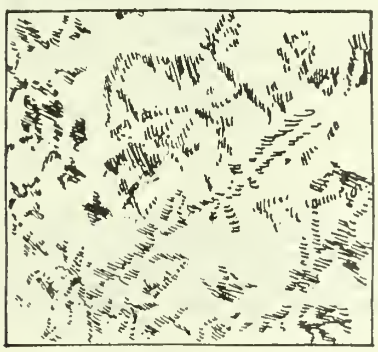


Fig. 14.—Alloy same as in Fig. 13. Chill cast 56.

Table 5.
Tenacity of Alloyed Press Zinc.

Alloy	Kind and shape of Test Material.	Resistance to rupture Kg per Sq.mm.	Elongation %	Impact Test Test bar like Pressed zinc Table 2. Kg per Sq.cm.	Hardness Ball Diam. 10 mm load 500 Kg. Kg per Sq.mm.
70% Zn 30% Al.	Round bar	25.4-33.3	15-19.5	1.3-2.4	--
" "	Round bar of 45 mm diam, pressed and afterward rolled, Test-bar of 8 mm diam, 80 mm gauge length.	32.3	17.5-26.7	1.1-1.4	84-89
" "	Test bar 5 mm diam and 50 mm gauge-length cut from pressed raw material	11.4-16.8	0.6-4.4	0.5-1.)	61-69

The working capacity of the alloy did not suffice, however, for the demand made by the subjection of the material to a sudden gas pressure, so that pressed brass in that way could not be used as a substitute.

The zinc alloys with high percentage of aluminum were thrown out on account of their instability. In the electrical industry where the metal parts were made from molded plates for years, decomposed, and should be given up. Since it depends materially upon the nature of the metal, upon the shaping of the parts and the manufacturing method, this experience without further explanation may be generalized. Experiments with such alloys during long intervals of time have shown no support for the general availability of the foregoing verdict.

Improvement for Alloys by Joint Action And Pressure

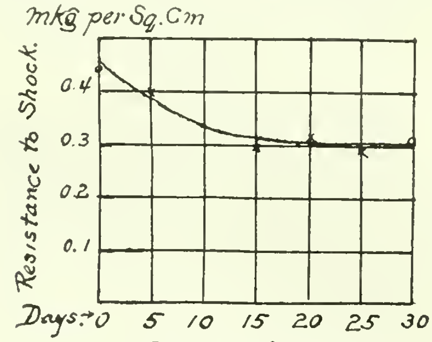
For the highest possible improvement of zinc, both kinds of betterment is reached by uniting the pressure with the alloy. In this way a material may be obtained that is sufficient for many demands as a substitute for brass. Then the designation of "Alloyed-pressed-zinc" was given to bar zinc that contained from 2 to 3 per cent. copper. The resistance to rupture is increased by the addition of copper, but the elongation is not; also the impact tenacity is increased but little. The metal was mostly pre-pressed in the bar-press and afterward rolled. For certain purposes, however, the disadvantage was met with that with copper-alloyed-pressed-zinc, this metal was more difficult to press into molds than pure zinc, so that for special purposes of working, complete bar section was taken into consideration. Also the pressed zinc has been alloyed with a small amount of aluminum; so that the alloy with 2 to 3 per cent. of aluminum was used to a great extent as a copper substitute. The aluminum-addition increased the ductility; the metal in the heated state may be easily pressed and sheared off, but the tenacity is not remarkably higher than the ordinary pressed zinc.

The highest tensile strength was to be expected with the application of the press-method upon such alloys which already had shown in the cast state the highest tenacity. Then the alloy with 30 per cent. aluminum as a pressed metal gave a tenacity up to 26 Kg. per square milometer, or 36,981 lbs. per square inch with an elongation of 10 to 37 per cent.; these values approximate therefore the values of pressed brass. Notwithstanding all this however, the energy still remains behind that of pressed brass and also the resistance to shock is not materially lower. Therefore it happens that with mold-pressing a great part of the metal's good properties are lost. From the molded metal the author has taken and determined the bars in various directions, that in places where a large displacement has taken place, the elongation disappeared, as table discloses.

It is therefore not surprising that this metal in special cases, where it would be submitted to a sudden development of gas pressures would not answer the purpose; however it shows in many other cases a useful purpose as a substitute for brass. As above with a suitable cast alloy there is also the instability as there is also with the presssed metal, and the work of this alloy, notwithstanding, has not been observed in a perceptible degree, after years of storage. Bodies worked with many small drillings and threads, stored for years, without alterations being shown by subsequent testing of their instructive stability. (It is remarkable and perhaps unfortunate in this series of interesting tests, that the property of the elastic limit of the various alloys was not recorded, if obtained, as that criterion is coming to be regarded by engineers as of greater importance than its associated property of the tensile strength, or the resistance of rupture).

STEEL BLUE ON BRASS

Dissolve 1½ drachms of antimony sulphide and two ounces of calcined soda in ¾ pint of water. Add 2¾ drachms of kermes, filter and mix this solution with another 2¾ drachms of tartar, 5½ drachms of sodium hyposu'phite and ¾ pint, of water. Polished sheet brass, placed in the warm mixture, assumes a beautiful steel blue.



× Daily 4-6 hrs at -10°C, otherwise at room temp.
o Daily 20 hrs at 70°C.
2 .. .. 0-3°C
2 .. .. room temp

Fig. 15.

Fig. 15.—Storage experiments during 30 days with the Zn-alloy Zn + 5 per cent. Cu + 3 per cent. Al. Fall of the impact tenacity in consequence of the storage with increasing temperature. The original mean value a half year before amounted to 0.7 mkg. per sq. cm.

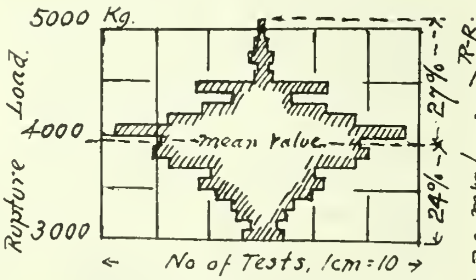


Fig. 16.

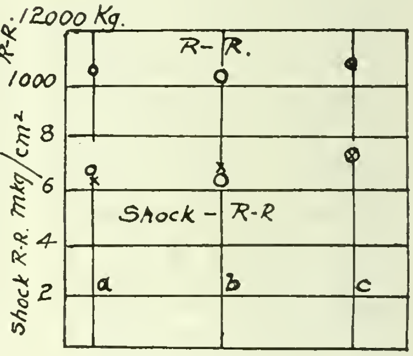


Fig 17

at a: {× = 100% New material; o = " Waste (Gate) heads}
at b: {× = 50% new material; o = 50% w.g.h + 50% chips}
at c · ⊗ = 100% chips
R-R = Resistance to Rupture

Iron Cast and Otherwise; Some Early History

Iron Was Undoubtedly Known to the Egyptians and Other Ancients But It Was, In All Probability, Something of a Rare Curiosity

THE working of iron and steel is unquestionably one of the oldest of arts. It is known that iron was produced and used at a very early date, probably in prehistoric times.

Early Uses

In the Bible (Genesis IV, 22) we read of Tubal-Cain, son of Lamach and Zilla, as "an instructor of every artificer in brass and iron."

We can properly call Tubal-Cain and those early metal workers "smiths," even though they sometimes worked in brass, as their principal work was the making of armor.

We find abundant references to show that this earliest of trades was held to be highly important. In First Samuel XIII, 19, we find, "Now there was no smith found throughout all the land of Israel; for the Philistines said, Lest the Hebrews make them swords or spears;" And we find that Nebuchadnezzer followed the same course among the Jews (II Kings, XXIV, 14), "and he carried away all Jerusalem, and all the princes, and all the craftsmen and smiths; none remained, save the poorest sort of the people of the lands." Jeremiah XXIV, 1, also states that Nebuchadnezzar carried away the carpenters and smiths.

The extent to which the work of these early smiths was carried can be seen from the following references to the Old Testament: Axes, Deuteronomy XIX 5; II Kings VI, 5; stonecutters' tools, Deut. XXVII, 15; armor, coats of mail and weapons of war, I Samuel XVII, 7—38; iron bedsteads, Deut. III, 11; iron pens Ezek. IV, 3.

We know little about the early smiths and their work, or their method of working the iron. An ancient wall-painting, shown in a former issue of Canadian Foundryman, probably gives as reliable a idea as can be found. The fire was built in a slightly depressed place in the ground; a forced draught was given to the fires by an attendant on either side, who worked bellows which were placed on the ground in such a manner that they would blow the fire. The attendants worked these bellows by standing on them, alternately throwing their weight from one foot to the other and pulling up the bellows with a rope as the weight was relieved, thus permitting the instruments to be emptied and filled alternately.

The use made of iron by the early Egyptians is a debatable point, for some writers maintain that the Egyptians must have used it in war; while some claim that it was used merely as a precious metal. Egyptian specimens found in tombs and elsewhere are so few that the proof is slight. Recently discovered Egyptian iron finger rings and other articles of personal adornment imply that this metal was scarce and of great value. On the other hand, some of the articles unearthed are an iron-bladed adze with an ivory handle, a thin fragment of wrought iron plate found in an air passage of the Great Pyramid, and an iron blade of a falchion discovered under a sphinx at Karnac. These articles imply that the metal was somewhat abundant.

Herodotus, the Greek historian, thinks that iron was used generally by the Egyptians for weapons as early as the seventh century B. C. He believes this because when the Carians and Ionians invaded Egypt they were armed with brass and bronze weapons, and an Egyptian, who had never seen arms made from these alloys, ran to inform the king Psammetichus of the matter. In Egypt very few iron weapons have been found, however, whereas many of brass and of bronze have been unearthed. This may be explained, in part, by the fact that iron rusts more than brass or bronze and by the supposition that the brass and bronze weapons belonged to the invading armies.

Iron was known in Assyria and Babylon also. Excavations have brought to light various articles, such as weapons, finger rings, bracelets, chains, hammers, knives and saws. An iron store, the contents of which weighed approximately 385 tons, identified as unwrought ingots, was found at Korsbad. These ingots are pointed at both ends, with a hole near one end probably so that they might be strung together and more easily transported. Iron came into use early in Palestine and Phoenicia, also in China, Japan, Persia and India. It is claimed by the Chinese that steel was invented about 2,000 B. C. and that the Indian steel was known fully as early.

The early Greeks and Romans were acquainted with iron, and with them, as with the Egyptians, the first iron probably was of meteoric origin. That bronze was used before iron is recognized by Greek and Roman writers. Hesiod and Homer, Greek poets, have written of bronze, iron and steel. Iron objects have been disinterred at Troy and Mycene. The welding and soldering of iron is said to have been invented by Glaucos of Chois, about 600 B. C. Not only weapons of war were made of iron and steel but also crude farm implements. Iron was used also for ornamental vases and statues. At Delphi, a vessel of silver with a fancifully wrought iron base is described. Hercules is said to have had a helmet of steel and a sword of iron; and Saturn a steel reaping hook. Diamachus wrote in the fourth century that different kinds of steel were then produced in various places. The best came from Chalybes and India, although steel from Lydia and Laconia was noted. Anvils, pincers, hammers and even the bellows pictured on Grecian vases are similar to those used now.

The early history of the Romans tells us that they were familiar with this metal. Many iron articles have been found in Etruscan and in Roman graves at Pompeii, Vulci, and other places. In many instances, the utensils, weapons, and articles for use were of iron while those for ornamentation were brass or bronze. It is probable that the early Romans obtained most of their iron from the island of Elba, but after acquiring the sovereignty of the world, they probably mined and manufactured iron in their provinces of Corinthia, Spain, and on the Rhine, where it is presumed that they found well-established industries. In brief the Greeks and Romans knew iron and its use. They produced it in open hearths or ovens with the assistance of a natural wind draft or bellows, which sometimes produced a material similar to wrought iron and sometimes, steel. The fact that copper tools are found among antiquities would lead one to believe that there could not have been anything better, else why use a soft metal like copper. This argument, however, has its opponents who claim that copper was only used for special work, the same as to-day and that while steel tools were used for ordinary work they could not survive the ages, like those of copper. It is certainly a difficult question to solve, but since we see old copper axes, knives and chisels in our museums it seems to come naturally to look upon copper as the pioneer of all metals.

TIMES BRISK IN PORT ARTHUR AND FORT WILLIAM

Things are looking up in the Twin Cities of the Great Lakes, and we are looking for a lively season in all lines. Pulp and paper mills, elevators, boat repairing, and, incidentally, even something likely in the foundry and machine shop line.

The dry-dock foundry is gradually adding to its force. They are working on the machinery for a big new boat, the keel of which is to be laid early in the spring.

They had also bid on the big new paper mill, but the construction of this, at an early date, seems likely to be held up by the action of the bricklayers of the cities standing out for war-time wages.

Woodside Brothers are likely to do something in the line of moving and rebuilding in the spring, of which, more later on.

PATTERNS AND CASTINGS

By W. P. ESSEX

Some Small, Time-Saving Tools And Devices, Especially Useful to The Patternmaker.

THERE are very few shops to-day in which patternmakers are employed that are not equipped with a few wood-working machines of some description at least, such as a turning lathe, a circular saw table, a band saw; a buzz planer or jointer, and a trimmer, and where only these few machines are available, and they are kept in good working order, there is not the necessity for the extensive kit of tools, and the huge iron or brass-bound chest, heavy and cumbersome, which formerly housed the working equipment of the patternmaker, and encumbered the shop, often a source of worry and annoyance to the owner, and occasionally a subject for controversy and argument when assessed by the railroad as excess baggage for its transportation. Now with the equipment expected to be found in an ordinary pattern shop, the personal working outfit of the patternmaker does not need to be so large. A few carefully selected tools that may be packed in a large suit case will usually suffice.

There are a number of especially useful implements and devices outside of the regular line of tools that may be safely added to the kit case without unduly over-burdening it. In general, the patternmaker fits himself out with a particular type of standard wood-working tools, that are recognized as being most suitable to the peculiar requirements of pattern work, but in addition to these, there are a few other handy articles. In the following illustrations and descriptions, the writer submits a carefully made selection of special tools and devices particularly helpful to the patternmaker.

A tool that will be found exceedingly useful for scribing semi-circles on round or irregular shaped portions of patterns, is the coping trammel shown in Fig. 1. It is of very simple design, consisting of a metal base plate with a substantially fixed vertical spindle on which a rotating head is free to slide up and down. An offset on the side of the head has a square hole through which slides a radius bar adjustable to different radii, which are struck with a steel scriber or pencil held by a thumbscrew in the end of the bar. In use the device is fixed to a level board, the axis of the vertical spindle intersecting with a well-defined line drawn through the centre of the board and parallel with its sides. V blocks, or cradle, as shown at A and B of various sizes provide a most convenient means of holding the piece of work in position for scribing. This tool is adaptable to a wide range of work, particularly for marking round, oval, hexagon, or other shaped parts, for offsets or branches which are to intersect with the circular portions of a pattern. With the radius bar removed and laid parallel with the spindle, the tool may be packed into a very small space, and, if the head be made of an aluminum alloy, it will not be found too heavy for the kit case.

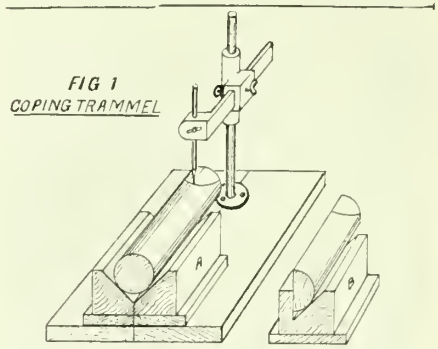


FIG 1 COPING TRAMMEL

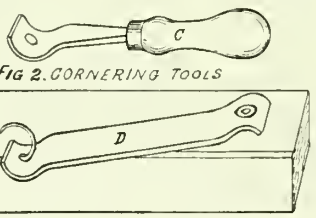


FIG 2. CORNERING TOOLS

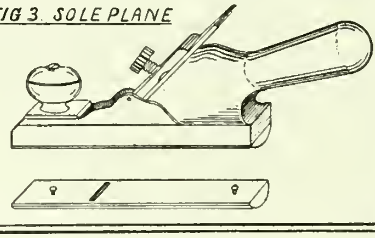


FIG 3. SOLE PLANE

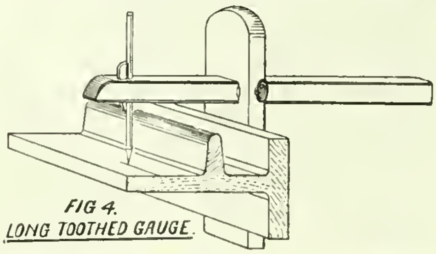


FIG 4. LONG TOOTHED GAUGE.

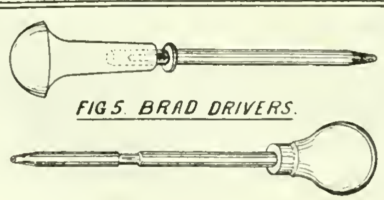


FIG 5. BRAD DRIVERS.

The Cornering Tool

It is generally considered good practice nowadays to round off all sharp corners from patterns, where square corners are not absolutely necessary. A couple of very handy tools are shown in Fig. 2, specially adapted for this purpose. The one marked C is possibly the best one to use but D is a more convenient shape having two cutters of different size in the one tool. These are made of flat steel about three-sixteenths by one inch, and six inches or so in length. There should be a pair of these tools, one with cutters for one eighth, and three sixteenths, and the other for quarter, and three-eighths radii.

A very convenient, shop-made tool of excellent design, is the sole plane illustrated in Fig. 3. Many uses will be found for this handy shaped plane especially in working out core boxes of diameters larger than three inches. There should be a number of detachable soles and round irons of varying radii provided, to correspond to diameters from three to eighteen inches.

The long-toothed gauge, Fig. 4, will be found very convenient when a parallel line is necessary on that part of a pattern which is not on the same level as the side desired to gauge from, as seen in illustration, or in gauging to parallel widths or sharp sweeps. Practice will suggest to the patternmaker many other uses for this valuable tool.

It is wasteful of time as well as annoying to pick up small brads with the fingers, sticky with shellac or glue, and repeatedly trying to start them in the wood, and after each attempt to find the brad sticking to the finger instead of in the work. It is also exasperating to have to pull out from a piece of work several crooked brads which have bent in the attempt to place them with the pliers, in an awkward corner of a pattern, or in the deep recess of a core box, not get-atable with a hammer and nail set. For bradding work in difficult places inaccessible by ordinary means, one or the other of those patented brad drivers, shown in Fig. 5, is recommended as a time and temper saver. The brad is magnetically picked up by the brad setter and securely held in the end of the tool, and with a slight pressure on the tool is driven into the wood without bending it. It is not even necessary to use a nail set, for the driver will set the brad deep enough, whether it be hard or soft wood, cardboard, or leather. The brad driver should have a place in every patternmaker's tool kit.

The panel gauge, Fig. 6, is essentially a joiner's tool, but the patternmaker also finds frequent use for it. While used for practically the same purpose as the marking gauge, its proportions are larger, and it is mostly used in gauging widths over six or eight inches. The sliding head is usually made about seven inches long, and the beam from eighteen inches to two feet. The work is gauged from the rabbet A which insures steadier guiding of the gauge than a plain face, the end of the beam at the marking point is made thicker, to line with the rabbet in the sliding head. In laying out drawings on a large board, the panel gauge will be found very useful.

In the making of small and medium-sized patterns especially that line of work which includes articles like pipe fittings, where branched and offset parts are coped on to other parts of a pattern, the coping saw, Fig. 7 can be used to good advantage for this class of work, and will be found to be a much better tool for a job of this kind, than the gauge. The pad saw is another good tool to have in the kit as it will save many a trip to the band saw for a trifling cut. It also comes in very handy for small jobs of inside sawing, where a jig saw is not available.

Patternmakers will find the Forstner bit, Fig, 8, to be a very useful tool. This bit differs from all other boring bits made for working in wood, it being guided by the rim instead of the centre. This unique construction permits of it being started on or over the edge of the wood, so that any arc of a circle corresponding with the diameter of the bit can be bored. The writer's experience with these bits in a limited way, has been very satisfactory, working exceedingly well in pine wood, and leaving a clean-cut hole. It is claimed for them that they will cut through, tough, hard, knotty, cross-grained wood, and leave a smooth hole, and a clean surface. As they have no centre spur they have the advantage over other bits of leaving a flat bottomed hole, which is often desirable, especially for making depressions in patterns that have to be planed out with a router.

As a means of quickly determining the thickness of material in parts of a pattern or casting that are difficult of access for measurement, as for example, over flanges, or the inside of cavities, or to obtain the thickness at the bottom of a depression, there is no tool more suitable than the thickness calipers, shown in Fig. 9. It possesses practically all the features of the regular transfer calipers, and for adaptability has advantages that the regular transfer type of caliper does not possess. It is particularly useful in relieving the back of carving in ornamental patterns like stove plate, to maintain a uniform thickness or in backing out small master patterns for lightening the metal patterns for match plating.

The marking calipers, Fig. 10, are used principally on stove plate and ornamental pattern work where a design carved on the face of a pattern, has to be relieved on the reverse side. The calipers are held in the hand, and the steel point B is made to follow around the carved design, the pencil A marking the outline of the pattern on the other side.

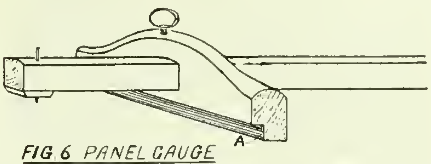
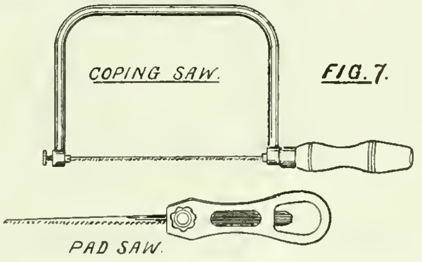


FIG 6 PANEL GAUGE



COPING SAW. FIG. 7.

PAD SAW.

FIG 8 FORSTNER BIT.

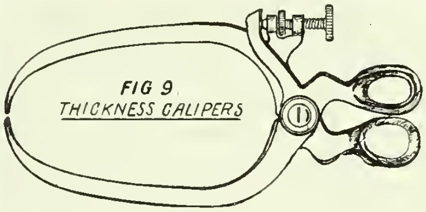


FIG 9 THICKNESS CALIPERS

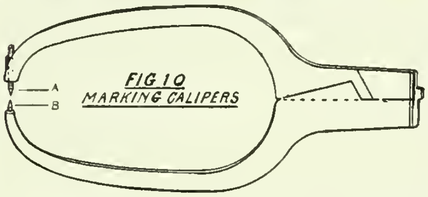
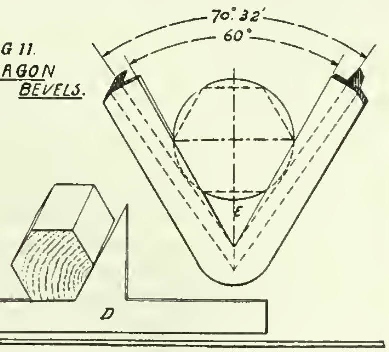


FIG 10 MARKING CALIPERS

FIG 11. HEXAGON BEVELS.



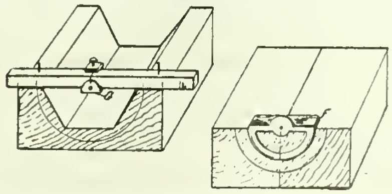


FIG 12. EDGE CENTRES.

A simple device that will save considerable time in laying off and marking hexagons on round work is shown at C. Fig 11. To obtain this useful little tool, it may be necessary to spend a few minutes in making a pattern, and have one cast in brass. The face with the 60 degree angle need not be more than ⅛ inch thick with a flange ⅜ inch wide set at an angle of 70 degrees, 32 minutes, the vertical line E bisecting both angles. D is a combination gauge and square for marking and fitting hexagons.

When striking an arc on a piece of work from a centre point on the edge of the material, as in marking the ends of a block for a core box, a common practice is to clamp or hold a piece of wood to the edge of the work, in which to place the point of the compass while striking the half circle. A more convenient way and just as accurate, is found in the use of the edge centre shown at F in Fig. 12. This is sometimes made of cast metal, but is usually made by bending a stout piece of sheet brass at right angles, and carefully locating the centre point and lines, then working it to the shape shown in illustration. G shows a little device with a small hole for a centre, for clamping on a square rod to use on a stepped or lagged box. Most patternmaking kits will contain some of these tools, but not in many kits will most of these tools be found.

AFOUNDRIA ASHORE

A news item of interest to those who attended the convention at Philadelphia in 1919 appeared recently in the daily papers, as follows:

"The steamship Afoundria from Hamburg, via Bermuda, for Mobile, is reported ashore off East Spit, Ship Island. A tug is standing by."

Part of the entertainment which the Philadelphia committee had in store for those who attended the convention was a trip up the river to the Hog Island shipyard, to witness a launching. The "Afoundria" was the ship, named in honor of the American Foundrymen's Association; the first two letters and the last one being A. F. A.

READS CANADIAN FOUNDRYMAN, YEAR AFTER YEAR

J. A. Paquette of St. John, N. B., writes: I am pleased to say that I have been a reader of the Canadian Foundryman for the past four years, and that I am well satisfied with it. To tell all the good things that I get out of it from month to month would be too long a story, but the fact that I will continue to be a reader of the Canadian Foundryman is the best answer of satisfaction that I can give.

Grey Iron Castings and the Foundry Chemist

Foundrymen of Great Britain Have Become Convinced That There is Opening for Improvement in Their Methods and Have Decided on Ways and Means of Accomplishing it

AT A MEETING of the Institute of Marine Engineers held at Tower Hill, London, Eng., a short time ago a paper was read on the subject of grey iron castings, by H. J. Young, F.I.C. It was a paper of considerable length but the first few paragraphs will convey to the reader, the difficulties which beset the foundrymen of Great Britain. Mr. Young's paper begins as follows:

Long before scientific control was thought of, the industry of ironfounding was carried on by rule-of-thumb methods—and very little change is to be observed in the majority of iron foundries in this country to-day.

What engineering owes to cast iron can be reckoned in terms of what engineering would be now if cast iron had never been, but while the engineer has used every possible resource of academic and applied science to the end of making his structures capable of greater things he has neglected the material that rendered most of those structures commercially possible, namely, cast iron.

Modern foundrywork is the sum total of thousands of little alterations by past generations of workers. Hundreds of men of widely different experience, education and calibre have contributed to these alterations, day by day and year by year, until now; the result being a trade wonderful in its empirical experience and behind all other trades in its scientific knowledge.

Without demand for science there has been little supply, and the building-up process has necessarily gone on without it. Thus have safety factors, thickness, rule-of-thumb mixtures, belief in certain pig irons, specifications of test-bars, and so forth been adopted and established to the degree of being almost beyond the criticism of those in power in most works.

That the ironfoundry trade will eventually walk in the paths of progress nobody doubts, also it may happen that sudden convulsive evolutions will occur as have occurred in the past in many other industries, for example, steel making and soap manufacturing. New materials are wanted to meet new conditions; an unscientific trade is being asked to cater for a scientific one; the engineer has, with one hand, locked his door against metallurgical science while, with the other, he has welcomed and embraced the science of engineering. He is now, in consequence, in the unfortunate position of having the latter asking for more than the former knows how to give.

Two instances alone should be sufficient to convince anyone as yet sceptical. The engineer uses a safety factor for cast iron, regardless of whether it may be eight, twelve or sixteen ton metal; he has deliberately agreed to look upon cast iron as an unreliable material. The second instance is that of the engineers' acceptance of the rule-of thumb mixture. It is well-known that pig irons vary from consignment to consignment yet, no matter whether he has been a maker, buyer or user, the engineer has shut his eyes to the fact that by no possible conjuring could the rule-of-thumb mixture give him metal of known or standard quality.

A consignment of any ordinary pig iron is little more homogenous than one of mixed scrap. Out of many hundreds of consignments of different brands the author has not found an exception.

Another article published in the Foundry Trade Journal of London, Eng., on the organization of a chemical laboratory at Keighley will be of interest to Canadians.

It will not be denied that so far as the foundry is concerned much has still to be done to bring our system of working and methods of production into line with the best Continental practice. The main contributory factor to this undesirable condition has undoubtedly been the persistent refusal of a large percentage of manufacturers to recognize the operation of a foundry as a scientific proposition; thus, until comparatively a few years ago haphazard methods were the rule rather than the exception, and mixtures were determined by "judgment."

Happily, however, these conditions will soon be relics of the past; in the large foundry they have already gone by the board, and a laboratory is now regarded as an essential auxiliary to the modern foundry of any pretensions.

Naturally, the fitting up of an efficiently equipped laboratory in a works entails very heavy overhead charges, which can only be sustained by such manufacturers who are in a position to engage their laboratory staff upon research work, in addition to meeting the everyday requirements of their works. The general foundry must be content with a very much more modest equipment, which will provide for ordinary analysis but offers no facilities for research, whilst for the greater percentage, which come within the category of "small foundries," the laboratory and chemist are commercially impossible, and the foundry manager, who is also the foundry foreman, has to carry out the duties of foundry chemist.

Obviously it is the small foundry which is the most heavily handicapped. The ideal arrangement is no doubt the employment of a chemist, whose duty it is to attend to the sceintific side of the foundry operations, and who would work in sympathy and close co-operation with the foundry manager.

The Formation of the Laboratory

The origin of the above company was the result of lectures given in 1918-1919 by Mr. W. H. Poole, of Bradford. He was then asked to address the members of the National Employers' Federation (Keighley and district) on December 3, 1919. The matter was then fully discussed, and it was unanimously decided that a private limited company should be formed by the engineering firms in the Keighley and District Association.

A committee was formed to draw up a concrete and workable scheme. It was, however, recognised that to promote the best interest of the industry the laboratory must be run as an entirely independent undertaking, the directors of the company controlling its financial workings but not having access to the results obtained for any individual firm. Shareholders would be benefitted only when the laboratory became a profit yielding concern, but they would have no advantages over non-shareholders in regard to the benefits to be derived from it.

HOW TABOR CO. KEPT PLANT RUNNING

When our representative called on the Tabor Mfg. Co., of Philadelphia, he got a good eye opener on how it is possible to run profitably even though times are quiet. In the early part of 1921 when it was seen that a quiet season was before them, they decided to make up a certain number of machines of each pattern and have them ready to ship without notice. Accordingly they called together those who supply them with material and had them give their best bids on what was wanted. By this means they operated their plant to capacity until February 1st, of this year, since which they are not so steady, but are filling orders and depleting the stock at a rate which makes them feel confident that good times are in store, and that their staff of three hundred workmen will soon be back on steady work. They report that during 1921 they shipped $75,000 worth of machines to France, and that they are filling telegraph and cablegram orders for machines at the present time.

PLATING AND POLISHING DEPARTMENT

Question.—In 1916 my present employers engaged in the manufacture of munitions, and a brass-plating solution which we had employed previously was placed in barrels and stored in a warehouse. I have just received an intimation that this solution would again be required for commercial plating. I anticipate trouble with it as I never was able to control results before it was stored. If you can suggest anything that might assist me in case of difficulty I shall appreciate the information.

Answer.—You are crossing the bridge before you reach it. Transfer the solution to the plating tank, and if possible to heat it, boil the solution for at least one hour, then electrolyze while cooling; use strongest current available, with small cathode and large anode surface. Note color of deposit, test with piece of polished steel, and if dirty gray, dilute to about 50 per cent. of its concentration, or to about 10 degrees Be.; add copper in generous quantities, electrolyze, and bring up to correct color by adding zinc carbonate dissolved in cyanide. If several colors appear on the plated surface add cyanide cautiously until clear yellow deposit is obtained and the anodes remain free from heavy dark coating. The solution removed when diluting the bath may be kept in a barrel and added to the plating solution when conditions require, or it may be added to an ordinary copper solution if care is taken not to add too much at a time. Small quantities of brass solution added to a copper bath often improve the copper deposits. We would prefer to use solution in this manner rather than keep it to add to brass solution as it is rarely necessary to add solution in this manner to a brass-plating solution unless the care of the latter has been neglected.

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Question. — Several nickel anodes which we placed in use some four months ago are still quite hard and exhibit only slight evidence of having been suspended in a plating solution used daily for commercial plating. There appears to be a form of ragged coating on these anodes, underneath which the usual black pasty substance may be seen through numerous holes. The nickel solution in which these anodes are hanging has become seriously weak in metal and we do not wish to continue as heretofore if possible to avoid it. Can you inform us of some method which will enable us to employ the anode without further loss?

Answer—The anodes which you have in the solution may be removed and the bark-like coating may be ground off or broken in many places so that the electrolytic action of the bath may affect the more easily soluble portion beneath. Anodes which have not been in use are quite easily ground in this manner: The anode is very lightly applied to a fine emery wheel and merely the dull outer skin removed. If you prefer to treat the anodes in the following manner you will save the labor of grinding and reduce the time loss. Fill a clean stoneware crock or a hardwood keg with a 50 per cent. solution of sulphuric acid and water; add 4 ounces of common salt per gallon and connect the container with the electric current in same manner as for plating except that the positive or anode rod should be placed across centre of top so that the nickel anodes to be treated may be suspended therefrom and be entirely surounded by cathodes of either lead, old nickeled holders, or brass. Use strongest current available for sufficient time to produce a black rather granular surface. Rinse in cold water after removal from the acid bath.

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Question.—I have orders to fill which necessitate the installation of some form of tinning bath. Would you advise using a tinning solution with the electric current or the dipping process with molten tin? There is a plating plant in operation on some premises from which I could secure suitable current.

Answer.—If your contract calls for a coating of tin which must be durable, we unhesitatingly advise you to use the hot tinning process. It is more expensive than the electric method and has not the wide range of useful application which is possessed by the electric method but dip tinning is really much superior to electro-tinning in respect to protection for iron or steel. An electro-tin solution which has given splendid results for several years and therefore is to be depended upon is composed of the following: 8 oz. pyrophosphate of soda, 1 oz. tin chloride, 1 gal. water. These quantities may be increased slightly or decreased to ¼ above figures if the proportions do not vary appreciably. Both tin and soda will be required to be added occasionally to maintain proper working conditions. Slimy anodes denote excess current or deficiency of soda in the solution. It may be said that tin solutions are not wholly maintained by the disintegration of the tin anode and require special attention in current regulation and the solvent must be maintained quite constant if uniform results are expected. Use as large anode surface as possible. If a zinc coating would answer your purposes you will find the following a very satisfactory formula. Water, 1 gal.; zinc sulphate, 10 ozs.; aluminum sulphate, 7 oz.; ammonium chloride, 1 oz.; prepare in usual manner and add 8 ozs. of tin salt to each 25 gallons of the zinc solution. The deposit from this solution is very dense and unusually white, and could be successfully employed on goods which are not to be used for culinary purposes. It is easier to operate and keep in working condition than the tin solution.

Question.—Please give me the following information and oblige an appreciative subscriber. My copper solution plates very rough and the plate is hard to buff. Why does a nickel solution deposit dark, brittle coatings? My work consists of grey iron castings and occasionally some brass castings.

Answer.—Cyanide copper solutions may produce rough deposits sometimes streaked or discolored if too strong current is used when the metal strength of the solution is low, or free cyanide deficient, or impure copper salts are present. Acid copper solutions which have not enough free acid will give similar results. Alkaline nickel solutions usually yield dark deposits. Nickel solutions of normal acidity may yield dark plates if the conductivity of the solution is poor. Copper in any form introduced into the nickel solution will cause dark deposits. Nickel solutions excessively acid produce brittle deposits, the plate is hard and usually non-adherent on highly polished surfaces. Increase the metallic content of the solutions, neutralize, and add a good conducting salt. Use extra care in rinsing all castings previous to placing same in the nickel solution. Keep the solutions clean and maintain a large effective anode surface at all times. Use the solution as a friend. Do not neglect it.

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Question.—Our plater, who evidently is a progressive fellow, wishes us to provide him with nickel anodes 95-98 per cent. pure. During our experience in the manufacture of nickel-plated grey iron castings we have always specified 90-92 per cent. nickel anodes, and as far as our knowledge of electro-plating goes, we have produced a very creditable plate. We now wish to be informed as to the superiority of 95-98 per cent. nickel anodes over nickel anodes of the 90-92 per cent. variety. Is the finish better, the expense of operation less, the output greater, and what is the difference in price?

Answer.—Your plater's request is indeed worthy of your sincere consideration. Anodes being the source of metallic supply, should be as nearly pure as possible. When you buy 90-92 per cent. nickel anodes you pay the price of nickel for at least 6 per cent, of iron, and, with nickel anodes selling at 50 cents per pound, we believe you will agree that this is a high price to pay for iron with which to contaminate the plating bath and the electro deposit, and finally wash down the sewer as a total loss. Pure nickel anodes produce better colored plates; they allow of a wider range of conditions without the appearance of faulty or burned deposit. Pure nickel anodes permit of better maintenance of a constant composition of the

(Continued on page 42)

The Apprentice and the Journeyman Mechanic

From the Gild Merchant Sprang the Craft Gilds Which Included Master, Journeyman and Apprentice—Which Later Dissolved and Ultimately Developed Into Opposing Factions

SINCE, by divine decree we have to work for our living, we are up against the problem of knowing how to work. In order to learn how to work we have two points to consider, that of having an instructor to show us how and that of practising what we are being shown. This is what is known as serving an apprenticeship. After we have served a term of this kind and become proficient at the trade we do not feel like disposing of our knowledge and labor combined for what ever price is offered, without being consulted on the subject. Neither do we feel like having some other fellow come along and offer to take our job for less money than we are receiving, so we combine together and agree amongst ourselves and try to make agreements with our employers so that everything will be agreeable. This is what is correctly known as trades unionism, and incorrectly known as organized labor. When a boy serves an apprenticeship and then joins an organization, he knows that as a laborer he has not improved, but he has a trade which he wants to protect. That unions as well as employers have abused their privileges is undoubted, but this has always been since the beginning of time. To give an insight as to how the system originated and developed, and how the weaknesses of humanity led up to unpleasantness, we will reproduce some information gathered from the Encyclopedia Britannica, Wells' Outline of History, and Cheney's Industrial and Social History of England, by "The Wisconsin Apprentice."

It would be impossible to study the history of apprenticeship without knowing what the gilds were and without some understanding of how people lived in the 12th and 13th centuries. Because we have the most complete records of the economic history of England we shall consider that country's history although the same conditions existed in Germany and France at the time.

At that time agriculture was the chief occupation of the people living in the villages. All country life, by the way, was village life. Each village, "vil" or "manor" as it was called, was in the hands of a lord who might be a knight, nobleman, bishop or king. The inhabitants were divided into a number of classes ranging all the way from freeholders to serfs, and each class had certain distinct privileges. All, however, were tenants to the lord who was something like a large farmer except that he had a constant supply of labor at his command for which he had to pay no wages. The tenants were little more than slaves who could not leave the village and who had to spend a certain amount of time working for the lord and who had some time to work the little piece of land allotted them for their own use.

The town, however, usually had some form of self-government and held a charter from the king. Here, too, the rights and privileges of the people varied. In addition to agriculture, trade and some manufacture were carried on. The prosperity of the town depended mostly on trade. All merchants belonged to an organization called a "gild merchant," the chief aim of which was to preserve the monopoly of trade for its members. The gild, it seems, had authority to make rules and regulations governing trade very much as if it was a department of the town administration. In fact, it is hard to distinguish the early gild merchant from town government.

Merchants from other towns could not come in to sell goods without complying with the rules and regulations as laid down by the local gild. The gild would dictate to these foreign merchants just what articles could be bought and sold, at what prices, and also the length of time to be spent in town. As for the local gild each member took an oath of admission, paid an entrance fee, and made small annual contributions to the common fund. The brethren were aided in old age, sickness and poverty, loss by robbery, shipwreck, and fire. The gild merchant sometimes fulfilled various religious and charitable duties to the public as well as to its members.

By the 14th century another type of gild appeared, the "craft gild." It is not known definitely whether at this time craftsmen were excluded from the "gild merchant" or not. It is possible, however, that since the craftsman bought raw material, manufactured it into the finished product and then sold it again that he could belong to both his own craft gild and the gild merchant at the same time.

The coming of the craft gild marked the gradual decline of the gild merchant. Whenever the king bestowed upon the weavers or tanners, or other body of artisans the right to have a gild, they naturally secured complete control over the manufacture and trade of their branch of industry, and so with every new craft gild the power of the gild merchant was lessened until finally the latter was crowded out altogether.

Every trade had a gild. We find among them the goldsmiths, swordsetters, cooks, arrow-head makers, fishmongers, hatters, casket-makers, surgeons, marines, innholders, clothiers, peddlers, saddlers, butchers, carpenters, plumbers, etc.

Among other things the craft gilds supervised workmanship and so assured the public of the best of wares, it supported the interests of the full masters of the craft as against those in the journeyman stage, and enforced the custom of the trade in hours, materials, methods of manufacture, and often in prices. No craftsman could work at his trade unless he was a member of the local gild.

In the 13th century the trade of England continued to expand and the number of crafts grew. In the 14th century they were fully developed and in a flourishing condition and every town had its gilds.

Factories did not exist. Manufacturing was carried on in the individual homes of the masters. Usually the master had a small farm in connection with his regular trade and would divide his time between the two. Every master had a journeyman and an apprentice or two. The apprentice lived with the master and was expected to work on the farm whenever necessary. The term of apprenticeship was seven years and no person who did not serve seven years as an apprentice could exercise any trade or "mystery." After seven years the apprentice became a journeyman and if he had money enough he could later set himself up as a master, hire journeymen and train apprentices. All three, apprentice, journeyman and master, belonged to the same gild. Usually the members of the same craft lived in the same locality—that is, the carpenters lived in one section of the town and the tailors in another. Thus the gild craft, like the old gild merchant, combined close relationship with a distinctly recognized and enforced regulation of trade.

In 1439 the Black Death came—that terrible pestilence which came nearer to wiping out civilization than any other cause. Half the population of England, it is estimated, died. This disaster had some far reaching effects and many changes took place. Labor grew scarce and demanded double and triple the old rate of wages. This was met by strenuous opposition of the law. In 1531 the "First Statute of Laborers" was passed. Later this law was reenacted with additional penalties attached. This law regulated wages, punished refusal to work, and prevented workmen from moving about from town to town. Hiring was to be done by the year, and any unemployed person qualified to work was bound to accept service on pain of punishment, if required, unless possessed of a certain amount of property or engaged in art, science or letters or being a "gentleman." Hours of labor were fixed. Workmen had to be "at work at or before five o'clock in the morning and continue at their work and not depart until betwixt seven and eight at night, except it be in time of breakfast, dinner or drinking (drinking here is meant gild meetings,) which time at most shall not exceed two hours and one-half in a day."

There was now a new class of journeymen coming into existence who remained permanently employed and never attained the position of master craftsman. This was sometimes the result of deliberate action on the part of the masters who began to compel apprentices to pay excessive payments (more than fifty dollars in our present money) in order to become full members of the craft. In some trades masters required apprentices to take an oath at the time of indenture that they would not set themselves up as independent masters when the apprenticeship was over. However, Parliament later took a hand and forbade these practices.

These conditions led journeymen to form organizations of their own generally described as "yeoman" or "journeymen gilds." The result was a struggle between the journeymen and the masters who were now employers in the modern sense of the word. This conflict was widespread throughout western Europe but was more prominent in Germany than in either France or England.

In addition to these internal changes in the gilds other influences were at work which gradually weakened the gilds, "companies" or "mysteries" as they were later called. The gilds had to contend with a class of irresponsible men who refused to conform to the established rules of the trade and who did not serve an apprenticeship. In addition to this the gilds had to suffer from government intrusion. Formerly the gilds enforced all laws pertaining to their trades but now statutes were passed entirely ignoring the gilds. This is especially true of the "Statute of Apprentices" passed in 1563. This statute which remained in force for two hundred and fifty years, was primarily a relenactment of the "Statute of Laborers." By this law all relations between masters and journeymen were regulated by the government instead of by the craft gilds. In this way the power of the gilds was gradually taken away from them.

Space is too short here to detail the numerous other causes for the decline of these gilds or tell of the labor legislation enacted during these times, or give the interesting history of the change in manufacturing methods which took place.

The gilds came to an end altogether during the Reformation. Most of the gilds had property in their possession given by members on the condition that the gild would help or support a priest and that mass be celebrated for the soul of the donor and to keep a light always burning before a shrine, or for other religious objects. The reformers who were quite influential under Edward VI looked upon this as superstitious and hence secured the passage of a law confiscating all funds and property of the religious and gilds and that part of the property of the craft gilds devoted to religious purposes. The gilds were then forced to pay annual amounts to the government so that finally the gilds had to sell and mortgage their land to meet these payments.

Noted Foundry Expert

Acknowledged Authority on Topics Appertaining to Foundry and Industrial Institutions.

AS A GENIUS, a mechanic, and a scientist, the foundry profession has no more conspicuous a personage on the American continent than Henry M. Lane, president of the H. M. Lane Company of Detroit and Windsor.

With a genial disposition and a striking personality in general, Mr. Lane has become an acknowledged authority on topics appertaining to the foundry and industrial institutions in general.

Mr. Lane comes from a family which had been connected with engineering for several generations. He was born

H. M. LANE, M.E.

at Ispheming, Michigan, in May 1868, at a time when his father was equipping the first mine in Michigan which was equipped with hoisting and handling machinery of a type which could be called equipment in the modern sense. Soon after the subject of our story was born, the family moved back to their old home at Akron, Ohio, where for many years Mr. Lane Sr. was connected with the Webster, Camp and Lane Machine Co., pioneers in the manufacturing of mining machinery. The foundry and machine shop of this institution answered as play house for the young son. Later on they moved again—this time to Chicago, and at the age of sixteen, Henry went to work for the M. C. Bullock Co., manufacturers of mining machinery. He remained with this firm until he had completed a four year apprenticeship, after which he went to college at Purdue University, taking both graduate and post-graduate courses there, specializing in metallurgy and chemistry, and on certain other subjects which have since proven of interest to him in his work. After graduation, a number of years was spent mainly in the mining machinery business, during which period his work took him all over the Rocky Mountain region, and over a considerable portion of Canada. In his work during succeeding years he had charge of different foundries and on different occasions was called upon to design new buildings, a position for which he was eminently fitted. With his experience, his education and his natural aptitude he rapidly gained prominence in his sphere, being appointed to the position of principal, in charge of the writing of the Shop and Foundry Course of the International Correspondence Schools, at Scranton, Pa. This he carried through several editions.

His next move was that of "Editor," holding the chair in the office of "Foundry" which was at that time the leading foundry publication. From this he went to a similar position with "Castings" and later brought out the paper known as "Pattern-Maker."

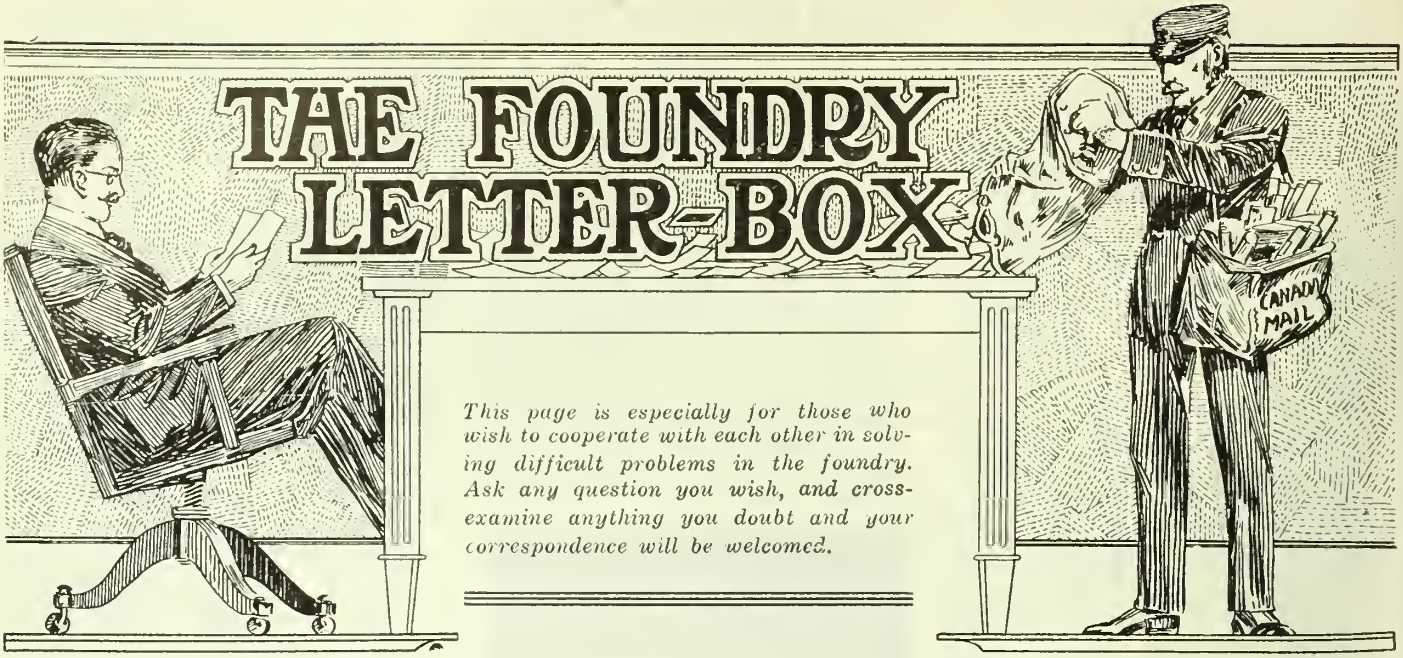
While in the various editorial positions, he carried on consulting work, mainly from a metallurgical standpoint, but he early found that many of the troubles lay much deeper than the metal and this resulted in his making a special study of molding sands, core sands, core binders, and many other problems entering into foundry practice. This led him farther and resulted in his having to specialize in Foundry Engineering and the getting together of an organization of engineers to handle foundry buildings and equipment problems.

In the last twenty years he has served between four and five hundred firms in a consulting capacity, his work ranging all the way from simple consulting jobs to the building of plants amounting to several millions of dollars each.

Mr. Lane has always been active in anything which tended towards the advancement of the foundry business. For many years he has taken a keen interest in the doings of the American Foundrymen's Association, having held the position of president. It was through his instrumentality that the exhibit feature which was inaugurated at the Cleveland convention in 1906 had its beginning. When the Foundrymen's Convention and Exhibit were held at the Canadian National Exhibition grounds, Toronto, in 1908 Mr. Lane was in charge. He is also a member of most of the engineering societies, such as the American Society of Mechanical Engineers; Institute of Mining and Metallurgical Engineers; British Iron and Steel Institute, American Society for Testing Materials, American Chemical Society; American Electrochemical Society; American Heat Treating Society; and other technical societies and organizations.

CARELESSNESS IS EXPENSIVE

At the tenth annual congress of the National Safety Council held in Boston a short time ago it was shown that industrial accidents in the United States cost annually one billion dollars and result in the death of twenty-thousand victims. The Council believes that practically all of this could be saved by proper safety precautions.



This page is especially for those who wish to cooperate with each other in solving difficult problems in the foundry. Ask any question you wish, and cross-examine anything you doubt and your correspondence will be welcomed.

MAKING SASH WEIGHTS FROM SCRAP TIN

The "Foundry Letter Box" Editor:

We have a considerable quantity of light tin plate clippings which we desire to melt and run into sash weights, but we do not know just what process to follow in the melting to get the greatest return, and write to ask if you would kindly give us information as to the process used in the foundries where they make a business of this class of work.

Answer, written especially for Canadian Foundryman by Dr. Edward Kirk: Tin plate clippings may be melted in an ordinary cupola of any size. In foundries which are equipped especially for melting this scrap a cupola of from 50 to 72 inches inside diameter is used. The charging opening is made very large, and the bottom of it is placed on a level with the scaffold floor. The clippings are brought up in bulk in crated barrows or trucks, and dumped in front of the opening. From here they are forked or pushed into the cupola on top of the coke bed. until a sufficient weight for a charge has been put in. Another charge of core and another of tin scrap are continued throughout the heat as in ordinary cupola practice. In this way tin clippings, tin cans, water pipe, gas pipe, and in fact any tin, steel, or wrought iron scrap that is not suitable for other work, but which can be gotten into the cupola is being regularly melted for sash-weights in large cities, or their vicinity, where such scrap may be obtained in abundance.

In many of our small foundries, it is the practice to melt a few hundredweight of tin scrap at the end of a grey-iron heat, for sash weights. This is generally charged in bulk, but if the cupola is small, and there is a tendency for the tin to hang up, it is baled up before charging. This is done by placing the clippings in a tub of diameter to suit the size of the cupola, and ramming them into a solid lump with a heavy rammer.

Scrap tin plate is some times put through an acid process in order to recover the tin for the making of the chloride of tin. The clippings have been pressed into solid ingots by hydraulic pressure after the tin has been recovered. These ingots have been melted in the cupola and have given a good yield of metal when fresh from the acid bath, but when kept in stock for some time, are so corroded by the acid, that they yield nothing but slag. It must be remembered that all metal obtained from this class of scrap is very hard and brittle, and requires very careful handling, even in sash weights, to prevent breaking.

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WHAT IS SPELTER?

Editor, Canadian Foundryman.—Will you inform me what is the formula for spelter and for what is it used?

Answer:—There is no formula for spelter for the reason that there is no such material. Spelter is just a nickname for zinc. The only excuse ever put forward for the word being coined, was that the word "zinc" is usually intended to designate sheet zinc such as is used under stoves, etc., and in order to have a word which would mean block or pig zinc the word "spelter" was brought into existence. It has, however, no other meaning than just simply zinc such as is used in the foundry. The American Zinc Institute, which was formed a few years ago, and which includes in its membership practically every zinc mining and zinc smelting interest in the United States, has as one of its objects, to free zinc from its many nicknames and is making an effort to discourage the use of such names as spelter. Many trade journals, the United States Geological Survey, and the Bureau of Mines, have agreed to always call zinc by its right name which is "zinc" and not spelter.

WANTS INFORMATION ON TELESCOPES

Editor, Canadian Foundryman:—Since reading the last few issues of your paper, I am convinced that you have an astronomy expert on your staff and that I need look no further for the information which I have been wanting for some time. I am not an astronomer and never expect to be, but I like to read and study about the heavens. What I want to know is, where is the largest telescope in the world? Where is Lord Rose's telescope, and is it not the largest? Who makes telescopes? Are they all made in France?

Answer:—We certainly have no astronomers on our staff and do not pretend to be an authority on telescopes. To the best of my knowledge and belief the largest telescope in the world is in America and it was built there with the exception of the glass, which is really the important part of a telescope, and this did come from France.

For many years Lord Rose's telescope was the largest one known and in some respects it still is. There are two types of telescope to be considered—the refractor and the reflector. The refractor has to do with the rays of light passing through glass, while with the reflector the rays are brought to a focus by falling on a concave mirror.

At the time Lord Rose's telescope was built it was considered impossible to enlarge on the refractors already in use, so the reflector was depended on to do the work. The casting of this reflector was described in these pages some time ago and was quite interesting. It was made of speculum metal, an alloy of two parts of copper and one of tin. It was six feet in diameter, five inches thick and weighed about three tons. It was taken red hot from the mold and kept in that state in an annealing furnace for four months. This reflector is undoubtedly the finest piece of work of its kind in the world to-day, but as a telescope there are more powerful ones.

The Lord Rose telescope is at Parsonstown, Ireland.

A telescope with a 26 inch refractor was completed at the Naval Observatory, Washington, D. C. in 1873. These two were at that time the largest representatives of the two types ever undertaken. About the year 1880 a California millionaire by the name of James Lick died leaving in his will the sum of seven hundred thousand dollars to the University of California to be expended on the erection of a telescope, superior to and more powerful than any yet made. This left the trustees up against the proposition of choosing between a refractor greater than the Washington, or a reflector greater than the Lord Rose. They chose the former. While it may be only a coincidence that all the astronomical discoveries of note were made with reflectors, it was considered that the limit had been reached in this line and a better future was before the refractor.

In January, 1881, the contract was let to Alvan Clark & Sons of Cambridge, Mass., for an archromatic astronomical object glass of 36 inch clear aparature, to be delivered Nov. 1 1883. They let the work to Feil & Sons of Paris, who successfully cast the flint-glass disc in 1882, but the crown glass caused so much trouble that it was not until 1886 that is was accomplished, and in 1888 the telescope was complete.

The Lick telescope is therefore the largest and most powerful telescope in the world. The column on which it is mounted is cast iron 10 x 17 feet at the bottom, 4 x 8 feet at the top and weighs 20 tons. A description of the telescpe would be interesting but lengthy. The mechanism is such that as the earth revolves the telescope automatically follows the object being observed. This telescope is situated on Mount Hamilton, Cal. about fifty miles from San Francisco. The dome and other iron work in connection with the observatory were done by the San Francisco Iron Works, and the mounting and other mechanical work in connection with the telescope was done by Warner and Swasey of Cleveland, Ohio.

* * * *

WHY NOT BRING THIS PRIZE INTO CANADA?

The following announcement by the American Foundrymen's Association re the S. Obermayer award tell its own story and will require little comment. If there is one point which is more worthy than the others it is the fact that the competition is only open to the men who work in the shop. If Canadian employers will bring this to the attention of their men and will give them some encouragement, there is no reason why some Canadian molder or foundry foreman should not bring home this trophy. Here is the proposition:—

S. Obermayer Company Award

At the Columbus Convention in October, 1920, the S. Obermayer Company caused it to be announced that they desired to contribute the sum of $1,000.00 as a gift to the American Foundrymen's Association, the interest therefrom to be used by the Board of Directors in making awards of a suitable nature to be given for some accomplishment or meritorious effort by workers in the foundry, the award to be in the nature of a handsomely engrossed certificate, a special trophy, or a cash premium, at the discretion of the Board.

This gift was formally accepted by the Board of Directors, and the Awards Committee announces that the conditions of competition for this year's award will be as follows:

This award which is known as the S. Obermayer Company Award, will be given to the person submitting a drawing or model or some jig or device which, in the opinion of the judges, embodies the best ideas for a device to help in the economical production of castings. The jig or piece of equipment for which this award is given shall not be patentable, but shall be such a device as can be constructed in any foundry and used in the production of castings, in core-making, molding, pouring, or handling operations

The models or drawings of the devices which are submitted in this contest will be on exhibition in a booth at the Exhibition Building during the annual convention of the Association at Rochester, N. Y., the week of June 5th.

Contestants for this award will be limited to men who are foremen or workers in foundries, or in some department of a plant operated in connection with a foundry, and they should file notice with the Secretary of the Association of their desire to compete and receive further information as to conditions. In granting this award the judges will follow the general rules for granting awards laid down by the Awards Committee.

Members are urged to call attention of the men in their plant to this announcement, and to encourage competition.

* * * *

WHY READ A TECHNICAL PAPER?

Knowledge is the keynote to success. To get knowledge is the next consideration. Men without many opportunities have been successful, but when we sift their lives we find that, handicapped as they may have been, they struggled and got what knowledge was at their disposal.

Sidney Smith writing about one of the world's outstanding figures said:

"Yes, he is a miracle of genius, because, instead of trusting to the resources of his own single mind, he has ransacked a thousand minds; because he makes use of the accumulated wisdom of ages, and takes as his point of departure the very last line and boundary to which science has advanced."

How accurately the writer has placed his finger upon the secret of success! "Successful because he ransacked a thousand minds."

Andrew Carnegie often said that he owed his success to his ability to utilize the brains of others. Everyone in the iron and steel industry knows how large a part knowledge played in Schwab's success.

Study the lives of those who have achieved greatly and you will find that in practically every instance they were characterized by an intense passion for knowledge.

Knowledge is power—to know is to win!

The man who possesses ability alone will go only so far. Supplement his ability with knowledge and he'll reach the stars.

How about yourself? How are you going to get the knowledge that will take you to the top? There are many ways, but perhaps they are not all at your disposal. One means which is unsurpassed is that of reading the technical papers. This costs practically nothing and in many ways has advantageous features not found elsewhere. The privilege of asking questions and receiving the answers without expense is not the least of them. Canadian Foundryman only covers the foundry field, but it covers it properly. Like the genius referred to by Sidney Smith, we ransack everything which is known about the foundry business and hand out the knowledge thus gained, free of extra charge to those who pay the trfle that it costs to be a subscriber.

FLEXIBLE SHAFT COUPLING

A flexible shaft coupling which has a free turning motion around hardened steel pins and a sliding motion in a tongue and groove connection is now being marketed. Two styles of this design of coupling are made. A uniform velocity ratio, between the shafts connected, is maintained, irrespective of the amount of angular or lateral misalignment. The design also permits of ample end float essential when coupling up alternating current motors. In such installations the two sliding members slide in and out as occasion demands. One design requires two hubs to be keyed on the ends of the shafts to be coupled. Two rings on the hubs engage each other by means of a tongue and groove construction, and bearing pins driven transversely into each hub. The other design is similar except that the pins are driven directly into the shaft ends, the hubs being omitted. The pin in one shaft engages the slotted ring mounted on the other shaft end. The component parts of the couplings are made of machine steel and are heat treated. It is claimed that with slight changes in the construction a positive transmission can be had between shafts set at any angle up to 90 degrees. The coupling is manufactured by C. H. Breaker, Indianapolis, Ind., and marketed under the trade name of Bartlett, the name of the inventor.

F. H. BELL, Editor

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Technical Journal Devoted to the Foundry and Metal Industries.

B. G. NEWTON, Manager
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Business Picking Up

FOUNDRY BUSINESS is fairly brisk in some lines, but it is only in a round-about way that it has so happened. There are few lines that do not, to some extent, depend on the foundry, and when business improves in any of the lines, so dependent, the improvement is naturally reflected in the foundry. The present spring finds the building trades the busiest in several years. Every city, town and village has been experiencing a shortage of houses, and a decided start has been made towards overcoming this shortage. This however is not the main source of the building activity. On every hand large office and mercantile buildings are springing up, which all combined makes things lively in the brick yards and lumber industries, and likewise gives employment to many who had been forced through idleness to be out of the market for everything but the bare necessities of life. This, in turn, has made business better for the manufacturers of wood-working machinery, who report a decided improvement over a few months ago. The foundries which are directly benefited by the building activity are those engaged in the production of furnaces, steam and hot water boilers and radiators, bath tubs and other bathroom fixtures, soil pipe and fittings, columns, sash weights, locks, hinges, etc. This reflects further and enables the foundryman to spend a little money on improvements, thereby making business for other foundries. One Toronto soil pipe concern has found it necessary to install a larger and up-to-date cupola as well as overhead trolley track. Little by little business is coming back to normal.

* * * *

Market Conditions

VERY little change is noticed in the prices of foundry supplies since a month ago. Pig iron, scrap iron, scrap copper and brass are still holding at the prices quoted in our last issue. The demand, however is considerably more brisk. Foundry business is not booming by any means, but it is picking up right along. Brass founders, and those doing lines of aluminum casting report business exceptionally good, but prospects of any advance in prices are remote. On the other hand there is no immediate cause for belief that prices will drop materially. The coal strike will have the effect of preventing any drastic reductions in prices.

Can Buy Cheaper Than Make

A NOTICEABLE feature in connection with foundry business this spring is that manufacturers with foundries of their own prefer to let them stand idle and buy their castings, arguing that they can buy them cheaper than they can make them, while at the same time saving the trouble and annoyance of trying to do business with dissatisfied molders. This, of course, does not affect business in any way. The same amount of castings are made and the same number of men are employed. If the work is not done in one shop it is done in another, but it is nevertheless a ridiculous state of affairs. It should not be possible to buy castings cheaper than they can be made, and it should not be any easier for the other fellow to handle dissatisfied molders than for the man who is buying his castings. The whole thing in a nut shell is that the one foundry is run by a foundryman while the other is run by a non-foundryman; the one treats his molders as such while the other does the best he knows how to do, which is not much. Looked at from any angle, a foundry, to be a success, should be run as a unit by itself, by men who specialize on foundry work. It is not necessary to have castings made elsewhere; the foundry and the rest of the plant may all be under one roof, provided that the foundry is not contaminated with machine shop theory. Run the foundry as a foundry and put it in charge of men who know the foundry business and it will be a success.

* * * *

The Foundrymen's Convention

THE NEXT issue of Canadian Foundryman will be our pre-convention number and will contain everything worth while knowing about Rochester and the convention. Experience dictates that it is not well to make announcements too early, lest they be forgotten. We are, however, publishing in the present issue, such matter as will likely be of value to the prospective attendant. Our office is at the disposal of anyone who cares to write for information. Howbeit, everything is progressing in a most satisfactory manner and a rousing success awaits the convention. The local committees are preparing amusements and entertainment, which will be announced in the next issue, while the Foundrymen's Association is going the limit.

Watch for our pre-convention issue, but above all prepare to attend the convention at Rochester, N. Y., during the week of June 5th. Nothing will stimulate foundry business like a successful convention.

Technical Program for Rochester Convention

Advance Information for Those Who Wish to Make Reservations —Papers to Be Read at Sessions Include Some From England, France and Belgium

AN EXTENSIVE program of technical papers and reports has been prepared for the American Foundrymen's Association which is to be held at Rochester, N. Y., from June 5 to 9. The foundryman specializing in any branch of the industry will find much of interest in the program.

The coming convention will be of an international character, for besides the annual exchange paper of the Institution of British Foundrymen which will be read by F. J. Cook of the British Institute, two papers are being contributed by members of the French Foundrymen's Association and one by the president of the Belgian Association of Foundrymen.

One session will be devoted exclusively to papers and reports of the joint American Foundrymen's Association and National Research Council Committee on Molding Sand Research. While the work of the Committee has only been carried through its preliminary stages, many interesting facts have been uncovered regarding reclamation of old molding sand and methods of testing sand, and this session should prove of great interest to all foundrymen.

The Industrial Relations session has been planned to feature foremanship, safety work and education of foundry workers.

As has been the custom for the past few years, a joint non-ferrous session will be held with the Institute of Metals division of the A. I. M. E. The A.F.A. non ferrous session will be devoted largely to papers and discussion of the problems of the aluminum castings manufacturer. At this session it is hoped to bring together a large number of men interested in this new but increasingly important branch of the foundry industry.

An important part of several of the sessions will be the reports of the A.F. A. committees which have been working with the American Society for Testing Materials to better the standard specifications of casting metals.

In all, some forty-five papers have been secured for the eight technical sessions. For the benefit of those who wish to make hotel reservations for the days on which occur the sessions of greatest interest to the individual the following tentative convention schedule is given:

Tentative Program

For the information of those who wish to make hotel reservations and arrangements for attending the Convention on days that will be of most interest to them, we announce a tentative program for Convention Week.

Monday—A. M., opening of exhibits.

P. M., Joint General Sessions—A. F. A. and Institute of Metals Division, A. I. M. E. Address of welcome, response, etc.

Tuesday—A. M., Grey Iron Session;

P. M., Steel and Non-Ferrous Sessions.

Wednesday—A. M., Steel and Non-Ferrous Sessions;

P. M., Industrial Relations Session;

Evening, Annual Banquet.

Thursday—A. M., General Session—Molding Sand Symposium;

P. M., Special entertainment features.

Friday—A. M., Malleable Session; Final Business Session A. F. A.

P. M., Close of Exhibits.

Papers To Be Read

Flask Equipment for Molding Machines—by Arnold Lenz, Saginaw Products Co., Saginaw, Mich.

A Study of the Weight of Iron Castings—by J. D. Wise, Osborn Mfg. Co., Cleveland, Ohio.

Electrically Heated Metal Patterns—by C. A. Cremer, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Investigations Relative to Insulated Core Oven Design and Performance—by C. F. Mayer, Ohio Body and Blower Co., Cleveland, Ohio.

Belgian Method of Making Typewriter Frames—by J. Leonard, Liege, Belgium. President, Belgium Foundrymen's Association.

Design of Geared Ladles—by A. W. Gregg, Whiting Corp., Harvey, Illinois.

Electric Cranes in Foundry Service—by A. H. McDougall, Whiting Corp., Harvey, Ill.

Accurate Control of Analyses in Acid Electric Steel Furnaces—by A. C. Jones, Electric Steel Co., Chicago, Ill.

Proportions of Clay and Flour in Facings for Steel Castings—by R. J. Doty, Sivyer Steel Casting Co., Milwaukee, Wis.

Progress in Open Hearth Process—by Willis McKee, G. McKee Co., Cleveland, Ohio.

Side Blown Converters—by T. Leroz, French Foundrymen's Association.

Tests with Cerium as a Deoxidizer and Desulphurizer in Red Brass, Cast Iron and Converter Steel—by L. W. Spring, Crane Co., Chicago, Ill.

Impact Tests on Steel—by F. C. Langenburg, Watertown Arsenal, Watertown, Mass.

Manufacture of Manganese Steel in the Electric Furnace—by John Howe Hall, Taylor-Wharton Iron and Steel Co., High Bridge, N. J.

Research in the Foundry—by A. E. White, University of Michigan, Ann Arbor Mich.

Technical Control of McCook Field Foundry—by E. H. Dix, Jr., McCook Field, Dayton, Ohio.

The Use of Secondary Metal in the Brass Foundry—by C. T. Bragg, Michigan Smelting and Refining Co., Detroit, Michigan.

Porosity of Non-Ferrous Metals—by R. R. Clarke, Pittsburg, Pa.

Aluminum and Aluminum-Alloy Melting Furnaces—by R. J. Anderson, Bureau of Mines, Pittsburg, Pa.

Melting Aluminum for Rolling into Sheet—by J A. Lange, Western Springs, Ill.

Use of Secondary Ingot in Foundry Practice—by W. M. Weil, National Smelting Co., Cleveland, Ohio.

Two-Part Castings made in Three-Part Molds—by W. H. Parry, Brooklyn, N. Y.

Eye Protection and Safe Clothing in the Foundry—by Buell W. Nutt, The Safety Equipment Service Co., Cleveland, Ohio.

Time Study Applied to Foundry Practice—by A. J. Kramer, Deering Works, International Harvester Co., Chicago, Ill.

The Preparation of Steel Foundry Sand—by S H. Cleland, National Engineering Co., Chicago, Ill.

Tests of Molding Sand—by R. J. Doty, Sivyer Steel Casting Co., Milwaukee, Wis.

The Significance of the Screen Tests of Molding Sand—by H. A. Schwartz, National Malleable Casting Co., Cleveland, Ohio.

The Relation of Temperature to the Form and Character of Graphite Particles in the Graphitization of White Cast Iron,—by E. J. C. Fisher, Atlas Die Casting Co., Worcester Mass.

The Behavior of Fire Brick in Malleable Furnace Bungs — by H. G. Schurecht, Bureau of Mines, Columbus, Ohio.

The Manufacture and Properties of Refractories for Air Furnaces—by C. E. Bales, Louisville Fire Brick Co., Highland Park, Ky.

Carbon Dioxide Recorders—by D. M. Scott, The T. H. Symington Co., Rochester, N. Y.

Use of Oil as a Fuel for Melting Malleable Cast Iron—by S. Mackey and W. Hoernke, The Stowell Co., Milwaukee, Wis.

Tests on Cast Iron—by R. S. McPherran, Allis Chalmers Co., Milwaukee, Wis.

Steel Castings vs. Malleable Castings—by J. W. McKeon, West Michigan Steel Foundry Co., Muskegon, Mich.

Technical School Foundries—by Prof. J. D. Hoffman and R. E. Wendt, Purdue University, Lafayette, Ind.

Exchange paper of the Institute of British Foundrymen—by F. J. Cook of the Institute of British Foundrymen. The subject of Mr Cook's paper has not been received.

A new **McCloud Sand-Blast Machine** has just been installed by the E. J. Woodison Co. at the brass foundry of Booth-Coulter Co., Toronto.

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John L. Agnew, who, following his recent election to the board of the International Nickel Company, of New Jersey, has been appointed president of the International Nickel Company of Canada, a subsidiary of the former concern. Mr. Agnew resides at Sudbury, Ont.

* * * *

The Magnolia Metal Co., of Canada, located at Montreal, have completed their new factory and offices on Shannon Street and are now fully equipped for smelting and refining white metal alloys. The equipment includes new reverberatory furnaces and facilities for chemical research, etc.

* * * *

The United States Cast Iron Pipe and Foundry Company announces that it has purchased from a Canadian Syndicate headed by Gordon Perry the exclusive right to use the De Levaud patent in the manufacture of cast iron pipe by the centrifugal process in the United States, its possessions, and in Cuba.

* * * *

Wet cinder-mills have just been installed at the following three foundries —Gilson Mfg. Co., Guelph, Ont., Georgetown Foundry, Georgetown, Ont., and Forewell Foundry, Kitchener, Ont., demonstrating that foundrymen are opening their eyes to the amount of iron that has been going to the dump, but which it is not yet too late to save.

* * * *

The Toronto Hardware Mfg. Co. Toronto have just installed a new "Sheldon" Cupola and a complete equipment of overhead trolley tracks, manufactured by the London Machinery Co., of Guelph, Ont. Further installations are contemplated in the near future. The E. J. Woodison Co., supplied the equipment mentioned.

* * * *

New Foundry for Waterloo. The Waterloo Board of Trade is making an active effort to bring another large foundry to their town. The foundry which they have in view is now employing sixty hands, and, if brought to Waterloo it is the intention of the company to secure additional capital, double the capacity and give employment to over one hundred hands.

The plant of the Blystone Mfg. Company, manufacturers of sand sifters and other foundry equipment, at Cambridge Springs, Pa., was recently destroyed by fire. A new factory will be erected immediately.

* * * *

The Canadian Rampo Iron Works, Niagara Falls, Ontario, manufacturers of railway switches, crossings and switch stands are making extensive additions to their plant. Considerable new machinery has been installed and a new building is planned, representing, it is understood, a total outlay of about $100,000. Exceptional activity in railway construction is anticipated.

* * * *

The Lymburner Brass Works is a new institution which is being started in Montreal. The foundry which they are constructing will have a floor space of between 2,000 and 2,500 square feet. It will be an up-to-date brass foundry in every respect, designed especially for doing heavy work, but with facilities for doing small work equally as well. They will operate six furnaces. Mr. Winana is the manager, while Mr. Kert is the superintendent. Their address is 1025 Boyer Street.

* * * *

The Enterprise Foundry Co., Sackville, N. B., are running their foundry as well as all the other departments of their plant at about 80 per cent. of their normal capacity. This they have been doing for some time, and additional hands who are being taken on as the season advances will soon bring them up to normal. Considerable new machinery is being installed, principally in the sheet metal department but a large air compressor has been installed for the use of the foundry. Two new buildings have been erected during the last year.

* * * *

Foundry Resumes Operations.—The Electric Fittings and Foundry Company, 331 King Street West, Toronto, whose plant at Preston, Ont., has been practically closed for several months on account of the quiet times, have again opened up for business at Preston and feel confident that business will be sufficient to keep them running throughout the year. A. P. Stenborg who has been manager of the plant for some years is still on the job while R. Micks of Toronto is the newly appointed foundry foreman. C. W. Bongard, Toronto, is the general manager.

The Toronto Transportation Commission, will build a machine shop in the Hillcrest Park district, at an estimated cost of $100,000 in order to keep their equipment in repair. They are not building any foundry, but will require castings, thus creating business for the foundries which are already operating.

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The Standard Steel Plant at Port Robinson, Ont., was threatened with complete destruction by fire a short time ago. The fire is believed to have started from an electric stove in a shanty at the foot of the tank. The Welland fire department responded to the appeal for help and saved the property by pumping water from a forty-foot well which was practically dry when the fire was under control.

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A new **pipe foundry** is to be established at St. John, N. B. as a result of the decision of the council of that city to award a large contract for cast iron pipe to a local company which agreed that on receipt of the order they would establish a foundry, and make the pipes in the city as the beginning of a new industry. It is promised that the work will extend to a point where employment will be given to upwards of two hundred men.

* * * *

The Bishop-Blaney Corporation, manufacturers of street sweeping machinery have purchased the plant of the George W. MacFarlane Engineering Co., Paris, Ont., and expect to begin operations about the first of May. The streets surrounding the property have been paved so as to allow the sweepers to be properly tested before being put on the market. The foundry and other buildings are modern in every respect, and it is the intention to utilize them to their capacity.

* * * *

The York Pa., plant of The American Foundry Equipment Company is getting ready for bigger business by moving from the old location on North Street to large and better adapted quarters, on East Market Street, adjacent to the Maryland and Pennsylvania railroad. The company's molding machines, flasks, jackets and pattern mounting sundries are manufactured at this plant. Sand cutting machines, sand blast equipment, dust arresters and core machines will continue to be manufactured at the main plant, 2935 West 47th Street, Chicago.

Mr. George Valentine, Vice President of the Massey-Harris Company, who has for some time been in charge of the manufacturing end of the business and who is a director of the company was recently appointed president of the Bain Wagon Co., of Woodstock, a subsidiary of the Massey-Harris Co. Mr. Valentine is an able executive and one of the young Canadians who have forged ahead rapidly during the last few years.

* * * *

A new malleable iron foundry with Mr. W. F. McMahon, of Trail, B. C., as the secretary is about to be established at a point somewhere in the Province of British Columbia, presumably at Trail. The company has a patented article which they intend to manufacture, and they feel that they have sufficiently encouraging prospects to warrant the erection of a plant to do their own malleable iron casting.

Catalogues and Booklets

Vibrating Machinery Co., 546 West Jackson Blvd., Chicago, are issuing a neat pamphlet describing their "Sandhog" gyratory sand riddle. The claim of the manufacturers is that power is saved because only the screen is vibrated, because no power is wasted by a circular motion of the riddle and because of the rotary eccentric motor-housing. The motor is so designed that as the outside housing and field revolve it has the action of an eccentric fly-wheel. Many unique features are to be found on the machine.

* * * *

Northern Crane Works, Walkerville, Ont., are distributing a neat pamphlet, No. 24 G. treating on electric cranes, electric hoists; air hoists; air jacks; hand-power cranes; jib and pillar cranes; mono-rail trolleys; grab-bucket cranes, stacking cranes, gantries, etc. They call it a "pigeon-hole reminder" of what they are doing, but will send large catalogue to any one requesting same. It is profusely illustrated with views of the different cranes and hoists in actual service, doing jobs for which they are particularly suited.

* * * *

The Pennsylvania Wire Glass Co., Pennsylvania Building, Philadelphia, Pa. are distributing a large catalogue, treating on corrugated wire glass. The book is well illustrated and gives a lot of valuable information on the subject of structural work. This glass, it will be understood is placed on the frame work of the building. For a roof it fits right onto the rafters without any sheeting lumber. It admits light but holds back the glare of the sun. The wire netting strengthens it so that it can be walked up and also keeps it from falling to pieces in case of excessive heat. One advantage to windows provided with this kind of glass is that in case of a fire in a neighboring building the corrugated wire glass resists the fire and prevents it from entering the building. Its various uses and the methods of applying are fully described and illustrated in the catalogue.

* * * *

"Cupola Practice," third edition, just off the press and fully up-to-date on all modern cupola practice.

This work is designed to fill a long felt want by foundrymen on cupola practice. It covers the entire subject in a condensed form and in foundry terms that may be readily understood by foundrymen.

The extreme high price of coke for the past few years and heavy loss of castings due to attempts to save coke in melting, has called the attention of foundrymen more than ever to the importance of a proper system of cupola practice.

That is what is given in this text book, as gathered by the author from actual cupola practice when a young man, and many years of experience as a consulting expert, during which time he has been called to foundries in almost every state in the union, to locate causes of cupola trouble and systematize their melting.

* * * *

"The International Molders Union" of North America, by Frank T. Stockton, Ph. D. Professor of Economics, University of South Dakota, is a 222 page book published by the Johns Hopkins Press, Baltimore, Md. and is one of the series of books known as Johns Hopkins University Studies in Historical and Political Science, under the direction of the Department of History, Political Economy, and Political Science. It is an impartial review or history of the organization from its beginning up to the present time. The first paragraph of the preface will tell its own story. It reads as follows:—

"While the writer was a graduate student at the Johns Hopkins University, he wrote a monograph on the closed shop in American trade unions. This work led to a desire to study a single representative American trade union with respect to all its policies and problems. Largely upon the advice of Professor George E. Barnett, the Molders' Union was selected for investigation."

Like so many other things American, it had its origin in Philadelphia. An "Association of Molders" existed in that city in 1833, but it was not until 1855 that it received sufficient force to become a permanent organization, when Joseph A. Barford, a molder employed in Liebrant & McDowell's foundry, Philadelphia, headed a revolt against a reduction in wages and thus became "the father of local No. 1" Philadelphia, which still lives and holds the honor of being the oldest local in the industry with a continuous existence. The price of the book is **$1.50.**

SAVING COKE IN MELTING

By Dr. Edward Kirk

At no time in the history of foundry practice in this country has the coke-saving faker had a greater opportunity to work off his coke-saving systems of cupola practice than in the past few years, when coke was selling at as high as twenty-five dollars per ton and every founder was desirous of reducing his consumption of coke to a minimum.

Widely advertised coke saving systems have been bought and high prices paid for them; high-waged foremen have been employed who claimed they had a system by which they could melt 9, 10 or 12 to 1, with the result, no coke saved, the bottom dropped in the middle of a heat, with loss in output of castings, short moulding floors for the next heat, and full pay for the moulders, with the scrapping of many castings and waste of high-priced coke in re-melting scrap casting.

This I have found to be the case in many foundries to which I was called to investigate trouble in melting with a heavy loss of casting. Some few founders have been deceived by false cupola reports and actually believed they were melting 9 or 10 to 1, and give glowing reports of the new system, only to find later on that a car of coke did not melt any more iron than with their old system or foreman.

The cupola is the most economical and rapid-melting furnace in use for the reason that the metal is melted in direct contact with the fuel, and a larger per cent. of the heat developed by the fuel is utilized in heating and melting the metal than in any other furnace; and it is only necessary to have a proper distribution of fuel and iron and a proper volume of blast to obtain the best of results in melting from a cupola.

The utilization of heat in a cupola is a matter that I investigated more than forty-five years ago, and found that iron could only be melted within a given space in a cupola and all fuel consumed outside of that space was a waste of fuel; and I introduced at that time and placed in my work, "The Founding of Metals," published in 1877, the present system of placing iron and fuel in a cupola in charges, or layers of fuel and iron, that would admit of the charges of fuel settling into the melting one at a time to melt the charge of iron placed upon it.

This system was at once adopted in place of the system of mixing the iron and fuel as in blast furnace practice, and no man has been able to develop a better system, although many have claimed to do so, but all have failed; and until an entirely new system of placing fuel and iron in a cupola that will utilize a higher per cent. of heat in melting is found there is no possible way of saving the carloads and trainloads of coke claimed to be saved by so-called systems.

There have been some important changes made in construction of cupolas and some improvements in blowers since

I first began melting. The suggestion I made in my first work of increasing the height of cupola and enlargement of tuyeres has been generally adopted, and cupolas are now made by standard manufacturers of a height and with a tuyere area that utilizes the heat escaping from the melting zone in heating iron in a cupola and preparing it for melting, and admits of a proper volume of blast being supplied for the diameter of cupola, and both fan blowers and the rotary pressure blower have been perfected to an extent that there is no longer any trouble in procuring a blower that will deliver an ample volume of blast for a cupola of any diameter.

Cupolas and blowers having been perfected, it is now up to the foreman and melter to obtain the best of results in melting, and this can only be done by a thorough knowledge of the theory of combustion and heat and its application in cupola melting. To apply this theory in a practical way it is necessary that a foreman or melter should have a practical knowledge of cupola management in every detail, for the shaping of a lining, improper application of daubing, excessive burning of the bed, improper charging, etc., may be the cause of uneven melting, dull iron or a bad heat.

BRITISH FOUNDRYMEN WILL CONVENE

Now that the air is impregnated with talk of the American Foundrymen's Convention at Rochester, it is interesting to note that Great Britain is also having a Foundrymen's Convention and Exhibit during the same month.

This is not the first attempt but it is by all odds the most elaborate one, and like the Aemrican convention is paving the way for still better ones to come. Three days are being allowed and the various committees who are placed in charge are already beginning to notice that none too much time is at their disposal to carry out the extensive programme which is being prepared.

Birmingham where the convention and exhibition will be held is in somewhat of a unique position from a foundry standpoint, having 118 grey-iron foundries alone within its borders — more than any other city in Great Britain and probably more than any other city in the world. The Foundry Exhibition, which is to be held from June 15 to 24, is now in active preparation. The convention which is only to be of three days' duration will be held during this time—from the 21st to the 23rd inclusive.

There are features in connection with the British idea, which might well be considered on this side of the water. The skilled workman seems to attract more attention over there. Committees and sub-committees are now working out details for the competitions, the model foundry, historical exhibits, cinematograph shows and lectures on foundry subjects, which will be additional to those presented at the annual convention of the Institution of British Foundrymen. The details of the competitions are nearly completed, and will embrace core-making, molding and pattern making. The pattern making will be done at regular pattern making shops, but the core-making and molding competitions will be held in the exhibition buildings.

Three classes of core-making will be included—heavy, light and medium, with two types to choose from in each class. Similarly three classes will be available for the molding competition. Diplomas and substantial prizes are to be awarded.

From the details which are already available British foundrymen can congratulate themselves that they are to have this coming summer a convention which will materially differ from anything which has ever before been attempted in that country.

SHOW CONFIDENCE IN THEIR REPRESENTATIVES

W. H. C. Mussen, of Mussens Ltd., has fulfilled an obligation he committed himself to in March 1915, viz., to pay off the liabilities which existed when the firm was placed in voluntary liquidation seven years ago. At that time, as at present, this firm was engaged in the sale of railway, mining and contractors, and municipal supplies, and in common with such enterprises, sharply experienced the business depression which affected Canadian contractors during that period of the war. Faced by the further difficulty of profitably disposing of the heavy stock on hand, Mr. Mussen, president of the firm, decided that it was then advisable to apply for the appointment of a liquidator. It was announced at the time that the liabilities of the firm totalled $300,000, while the assets comprising merchandise on hand, realty holdings, open accounts, and bills receivable, amounted to $550,000, or approximately $250,000 in excess of the liabilities. As the stock carried was not of a character to be readily placed on the market, particularly during a period of depression with no construction work in sight, the action taken was regarded as offering the greatest possible protection to the creditors.

At the time Mr. Mussen declared the liquidation proceedings were not being sought with a view of reorganizing the business, and he was not in favor of such a proposal unless it would be one under which the creditors would each receive a hundred cents on the dollar.

At the time of the liquidation, John J. Robson was appointed liquidator, which position he has maintained ever since. With the completion of his services as liquidator Mr. Robson will enter the services of the firm as auditor.

During the seven year period since 1915 they have received the support of the manufacturing firms represented by them at the time of liquidation, with one or two exceptions. With these exceptions, the firm continue to represent the firms who were their creditors. During the period several other firms requested the firm to represent them, showing the confidence in which they were regarded.

PORTABLE SAND BLAST

There has been recently placed on the market a small size sand blast which can be easily conveyed about a plant. The equipment has a suction type gun in which the blast action is controlled by a trigger in the handle. Compressed air passing through the air jet creates a vacuum by which the abrasive, either sand or metallic, is brought from the hopper to the gun body, which has a mixing chamber where the air and the abrasive are given a swirling motion similar to the movement given a bullet by the rifling of a gun barrel. Interchangeable nozzles enable the equipment to be used under a number of conditions. Air pressure can be utilized when it is as low as five pounds and the apparatus functions very well at one hundred pounds pressure. A small cabinet is provided over the hopper of the sand blast, which feature provides an economical means of cleaning small parts. The cabinet can be easily removed if the nature of the work requires it. The sand blast is manufactured by the Pangborn Corp. of Hagerstown, Md.

THE TWENTY-FOURTH ANNUAL CONVENTION OF THE N. M. T. A.

The twenty-fourth annual convention of the National Metal Trades Association will take place at the Hotel Astor, New York, on April 19th and 20th. The program for the year, it is reported, is in many respects the most attractive which the association has ever been able to offer, subjects having been selected which it is felt everyone is vitally interested in at this time.

Among the subjects of vital importance to the metal trades which will be discussed at the convention is that of training apprentices to be the skilled all-round workmen. There are a great many methods of training apprentices in vogue in factories and shops to-day, and the committee on apprenticeship has examined these systems with great thoroughness. It has sought to incorporate their virtues and eliminate their defects in a training course which it has evolved. This course may be used in every type and size of plant.

A report which will be submitted at the convention will show courses of shop work for the apprentice, suggestions for a standard diploma, for an interchange of apprentices among the smaller or specialty shops, and other aspects of the apprentice situation which have occurred to only a few of the more advanced manufacturers.

Conditions in the coal mining industry and on the railroads will be discussed by speakers of national prominence; finance; the relation of the farmer to industry; the progress which the city of San Francisco and other large cities

have made in emancipating themselves from labor union domination; future industrial conditions in the light of the European situation—these are only a few of the subjects which will also be dealt with by able speakers.

PLATING AND POLISHING DEPARTMENT

(Continued from page 31)

bath, and they are more economical because they cost no more accordingly than an anode of less nickel content. The average commercial nickel deposit contains at least three per cent. of iron, when 90 to 92 per cent, anodes are employed. A portion of the iron is precipitated to the bottom of the tank in form of sludge. Ammonium citrate in the nickel bath will hold the iron in suspension and prevent the formation of sludge; the deposit, however, will contain approximately as much iron as was in the anode. This iron in the nickel deposit is one of the principal causes of premature loss of lustre to nickel deposit. The anodes should be fine grained and disintegrate gradually into a smooth soft mass, free from grit. The manner of casting evidently has a greater bearing on this feature of the anode than the actual proportion of metal. The output from a bath equipped with 98 per cent. nickel anodes should be at least 50 per cent. greater than is possible witht 90-92 per cent. anodes.

BRONZING BRASS CASTINGS

Yellow brass castings may be colored golden bronze by cleaning and spraying or brushing with a very weak muriatic acid pickle. They are next sprayed or brushed with a solution, using four ounces of sulphide of potash, two ounces of thialdine crystals, and four ounces of chloride of ammonium per gallon. By heating the castings any shade of color, from golden yellow to dark brown, can be produced.

BULLETINS

We have received from the Sarco Company Inc., New York, a bulletin, J70, describing their "Sarco" temperature regulators, and their method of operation. The regulators are constructed on the same thermal principles as the Sarco traps, and can be adapted to a wide variety of uses.

The patents and good-will of the "Jack Frost" Electric Refrigerating business formerly carried on by the Toronto Laundry Machine Company, of which the late John O'Neil was president, have been purchased by the "Jack Frost" Ice Machine Company, Limited, Toronto, with an authorized capital of $1,000,000.

Why Don't You Write?

HARDLY a week passes that Canadian Foundryman does not receive copies of this paper returned by the postal authorities because of the change in firm names or the address of some whose names are on the mailing list. Sometimes complaints reach us of the non-delivery of mail matter. It is not till the receipt of such complaints or the return of the paper, as the case may be, that we obtain any knowledge of the changes or removals of persons or firms. The adoption of the cooperative spirit on your part by notifying changes would make things a good deal more pleasant for both parties. The MacLean Publishing Co. want their mailing list to be in such shape that they will be able to render the perfect service to their subscribers. There is a lot of valuable trade matter mailed by this company and if you don't receive it—well, the fault is entirely yours.

CLASSIFIED ADVERTISEMENTS

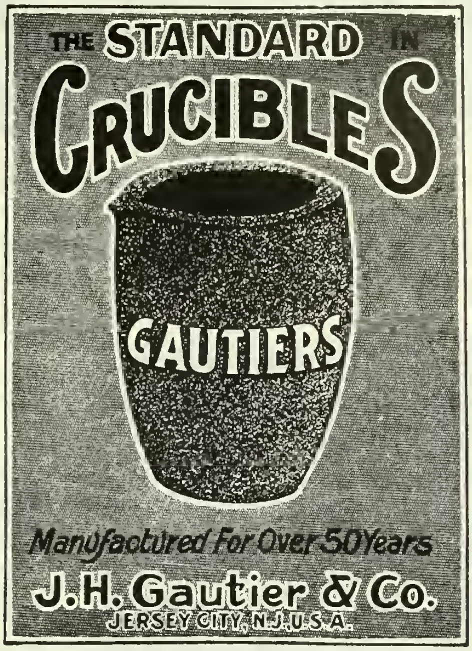
TWO CENTS A WORD, including the "Canadian Foundryman" box numbers; minimum charge is $1.00 per insertion, for 50 words or less, set in 6 point type. Each figure counts as a word. Display ads., or ads. set in border, are at card rates.

POSITION WANTED

BRASS FINISHER, GOOD ALL ROUND MAN, lathe and bench hand, plain pattern making, good knowledge of polishing and plating. At liberty April. Go anywhere. Box 704 Canadian Foundryman.

PRACTICAL FOUNDRYMAN, 25 YEARS ON light, medium, and heavy work, green and dry sand. Bench, floor and machine molding. Melt by analysis and thoroughly competent on Cupola practice. Good reference. Box 707, Canadian Foundryman. (C.3F.)

POSITION WANTED BY FOUNDRY Foreman, 25 years practical experience on Stove, Furnace, Boiler Sections, Match Plates, and Moulding Machines. Capable of figuring costs. McLain graduate, presently employed but desires change. Address Box 706 Canadian Foundryman.



FOR SALE

BARGAIN IN USED ELECTRIC FURNACE—A one-ton Volta Electric Furnace for melting steel, grey iron or Ferro alloy furnace, 220 volts, 25 cycle, 3 phase; complete equipment. For further particulars write Hiram Walker & Sons, Metal Products, Limited, Walkerville, Ont., P.O. Box 156. (c.t.f.f.)

Do you want to earn some extra money? This can be done in spare time by a man who has had good experience in foundry practice. The right man must be able to approach foundry owners and executives. If you have the right aggressiveness, you can earn as much, on the side each week as your weekly pay. If you are interested apply Box 708L, Canadian Foundryman.

J. & J. TAYLOR'S SAFES FOR SALE

One J. & J. Taylor Safe, inside dimensions 15 inches deep, 2 feet 6 inches wide, three feet 11½ inches high and fitted with a built in compartment. Price $250.00.

One J. & J. Taylor Safe 18 inches deep, two feet 9 inches wide, four feet 5 inches high, fitted with a steel compartment. Both safes are in good condition and can be bought at a price that will save considerable money to the purchaser. Price $200.00. Box 900, Canadian Foundryman. 153 University Avenue.

STEEL

Steel Ladles, Shanks, Flask Bands, Tote Boxes, Shop Barrels, Heavy Plate Tanks, Oily Waste Cans, Air Receivers, Smoke Stacks. Write For New Catalogue

THE STEEL TROUGH & MACHINE CO. LTD.
TWEED - ONT.

CLOSING TIME

Advertisements for this section must be in our hands on the 9th of each month.

In order that the announcements of your wants, etc., shall not be delayed, please try to have them in our office as early as possible.

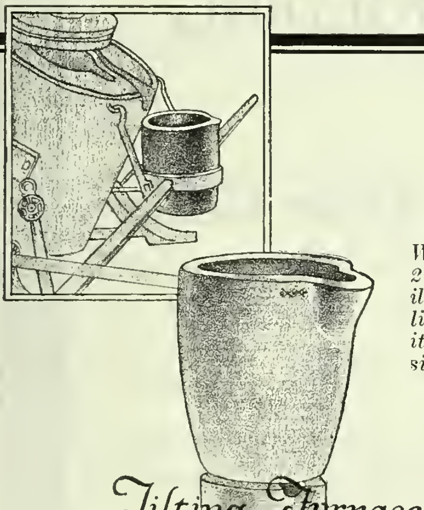
CANADIAN FOUNDRYMAN

Bailey & Bell Fire Brick Co.

Manufacturers and Importers of High Grade Fire Brick, Fire Clay and General Supplies. Special Shapes, Cupola Block, Stoker Brick, Boiler Tiles, Stove and Quebec Heater Linings.

MADE IN CANADA

1347-49-51 Dufferin St., Toronto, Phone Ken. 4335



DXN TRADE MARK

Write for Bulletin 27 A in which are illustrated the full line of Dixon Graphite Crucibles, their sizes and capacities.

Tilting Furnace Crucibles

Foundries using Rockwell, Ideal, Hausfeld, Case, "M.R.V." Monarch, or other tilting furnaces will find Dixon's Tilting Furnace Crucibles and Bases for same dependable and economical.

The name DIXON on any crucible gives assurance that it is **the standard** and is backed by nearly a century of experience in crucible manufacture.

DIXON GRAPHITE CRUCIBLES

Joseph Dixon Crucible Company
Jersey City, N.J., U.S.A.
Established 1827

FOR SALE

Fully Equipped

Modern Iron Foundry

NATIONAL TRUST COMPANY, LIMITED, Winnipeg, Province of Manitoba, Dominion of Canada, has for sale, under the Bankruptcy Act, the fully equipped and ready to operate plant of the Economy Foundry Company, situated at Portage la Prairie, in the Province of Manitoba, consisting of:

- PATTERN AND WOODWORKING SHOPS
- MACHINE SHOP
- FOUNDRY
- BLACKSMITH'S SHOP
- SHEET METAL SHOP
- SHIPPING ROOM
- CLEANING AND PAINT ROOMS
- WAREHOUSE

All of the above shops are completely equipped with all the necessary machinery and motors to carry on the business of an Iron Foundry, a full list of which can be had on application. Buildings are of substantial brick construction. Railway shipping facilities over the Canadian Pacific and Canadian National Railways allow ready connection with all markets.

For further particulars apply to:

NATIONAL TRUST COMPANY
LIMITED
WINNIPEG : : : : : : CANADA

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Directory of Foundry Supply Houses

The Buyers Directory of Canadian Foundryman was originally intended to con ain information regarding lines in the production of which the advertisers actually specialized. We now carry the advertising of leading supply houses, some of whom represent scores of manufacturers, in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the supply houses so we recommend that for all general requirements our subscribers communicate with the supply houses listed below:

The Hamilton Facing Mill Co., Limited, Hamilton, Ont.

George W. Kyle & Co., Inc., New York, U. S. A.

Frederic B. Stevens, Windsor, Ont.

The E. J. Woodison Company, Limited, Toronto, Ontario; Montreal, Que.

ANDDES, BRASS, COPPER, NICKEL AND ZINC
W. W. Wells, Toronto, Ont.

ARGGON
Dominion Oxygen Co., Toronto, Ont.

BENCH RAMMERS
I. Johnson & Son, Ltd., Toronto.

BLAST GAUGES
Clark Blast Meter Co., Gladbrook, Iowa.

BRASS FURNACES
' awley Down Shaft Furnace Co., Easton, Pa

CHAPLETS
Wells Pattern & Mach. Works, Toronto, Ont.

CHEMISTS
Charles C. Kawin, Chicago, Ill.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Indiana

CORE MACHINES
American Foundry Equipment Co., New York City.

CORE OVENS
Damp Bros., Mfg. Co., Toronto, Ontario.
Monarch Engineering Mfg. Co., Baltimore, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.

CORE PLATES
Damp Bros., Mfg. Co., Toronto, Ont.

CORE SAND
Benson & Patterson, Stamford, Ont.
George F. Pettinos, Philadelphia, Pa.

CRANES
Northern Crane Works, Ltd., Walkerville, Ont.

CRUCIBLES
Joseph Dixon Crucible Co., Jersey City, N. Y
J. H. Gautier & Co, Jersey City, N. Y.

CUPOLAS
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co, Cleveland, Ohio.

CUPOLA LININGS
Whitehead Bros., Buffalo N. Y.

DUST ARRESTERS
W. W. Sly Mfg. Co, Cleveland, Ohio.

EDUCATIONALISTS
McLain's System Inc., Milwaukee, Wis.

ELECTRIC RIDDLES
Great Western Mfg. Co.
Preston Woodworking Co.

ENAMEL WARE
Crane Limited, Montreal, Que.

FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FIRE BRICK
Bailey & Bell Firebrick Co., Toronto, Ont.

FLASKS
I. Johnson & Son, Ltd., Toronto.

FLASKS, SNAP
American Foundry Equipment Co., New York City.

FLASKS, STEEL
American Foundry Equipment Co., New York City.
Sterling Wheelbarrow Co., Milwaukee, Wis.
Trussed Concrete Steel Co., Walkerville, Ont.

FLUXES. IRDN, BRASS, ALUMINUM, CDPPER
Basic Mineral Co., Pittsburgh, Pa.

FLUOR SPAR
Basic Mineral Co., Pittsburgh, Pa.

FDUNDRY ENGINEERS
Charles C. Kawin, Chicago, Ill.
H M. Lane Co., Detroit, Mich.
McLain's System Inc., Milwaukee, Wis.

FURNACES, OIL
Hawley Down Draft Furnace, Easton, Pa.
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES, GAS
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES COKE
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES ELECTRIC
Volta Mfg. Co., Welland, Ont.

GRINDERS, PORTABLE
A. W. Sainsbury, Ltd.
Cleveland Pneumatic Tool Co., Cleveland, Ohio.

GRINDERS, SWINGING
A.W. Sainsbury Lt., Sheffield, England.

HEATERS
E. J. Woodison & Co., Toronto.

HEATING SUPPLIES
Crane Limited, Montreal, Que.

HDSE COUPLINGS
Cleveland Pneumatic Tool Co., Cleveland, Ohio.

INDUSTRIAL ENGINEERS
H M. Lane Co., Detroit, Mich.

KADLIN
Whitehead Bros., Buffalo N. Y.

LADLES
Damp Bros., Mfg. Co., Toronto, Ont.

LADLE SHANKS
Damp Bros., Mfg Co., Toronto, Ont.

MAGNETS
Dings Magnetic Separator Co., Milwau- Wis.

MAGNETIC SEPARATDRS
Dings Magnetic Separator Co., Milwaukee, Wis.

MALLETS
I. Johnson & Son, Ltd., Toronto.

METALLURGISTS
McLain's System Inc., Milwaukee, Wis.
Charles C. Kawin, Chicago, Ill.

METAL PATTERNS
Bryant Pattern Works, Windsor, Ont.
Hamilton Pattern Wks., Toronto, Ont.
I. Johnson & Son, Ltd., Toronto.

MOLDING MACHINES
American Foundry Equipment Co., New York City.
Benson & Patterson, Stamford, Ont.
Grimes Molding Machine Co., Detroit, Michigan.
Herman Pneumatic Tool Co., Pittsburgh, Pa.
Osborn Mfg. Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.
W. H. Nicholls, Brooklyn, N. Y.

MOLDING SANDS
Whitehead Bros., Buffalo N. Y.
A. MacMillan, St. Catharines, Ont.
Benson & Patterson, Stamford, Ont.
Geo. F. Pettinos, Philadelphia, Pa.
Venango Sand Co., Franklyn, Pa.

OXYGEN
Dominion Oxygen Co., Toronto, Ont

PATTERN MAKERS
Bryant Pattern Works, Windsor, Ont
Hamilton Pattern Wks, Toronto, Ont
I. Johnson & Son, Ltd., Toronto.

PIG IRON
A. C. Leslie & Co., Ltd., Montreal.
Steel Co., of Canada, Hamilton, Ont.

PIPE FITTINGS
Crane Limited, Montreal, Que.

PLUMBING SUPPLIES
Crane Limited, Montreal, Que.

PNEUMATIC TDOLS
Cleveland Pneumatic Tool Co., Cleveland, Ohio.

PULLEYS
Dings Magnetic Separator Co., Milwaukee Wis.

RIDDLES
Great Western Mfg. Co., Leavenworth, Kansas.
The Preston Woodworking Machine Co., Preston, Ont.

SAND
Benson & Patterson, Stamford, Ont.
Dick Sand Co., Franklin, Pa.
George F. Pettinos, Philadelphia, Pa.
Venango Sand Co, Franklyn, Pa.
Whitehead Bros., Buffalo N. Y.

SAND CUTTING MACHINES
American Foundry Equipment Co., New York City.

SAND MIXERS
Frost Mfg. Co., Chicago, Ill.
National Engineering Co., Chicago, Ill.

SAND SIFTERS
Great Western Mfg. Co., Leavenworth, Kansas.
National Engineering Co.
The Preston Woodworking Machine Co., Preston, Ont.

SAND BLAST MACHINERY
American Foundry Equipment Co., New York City.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.

SAND MULLERS
Frost Mfg. Co., Chicago, Ill.
National Engineering Co., Chicago, Ill.

SAND BLAST ABRASIVES
George F. Pettinos, Philadelphia, Pa.
Globe Iron-Crush & Shot Company, Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND RAMMERS
Cleveland Pneumatic Tool Co., Cleveland, Ohio.

SANITARY EQUIPMENT
Crane Limited, Montreal, Que.

SNAP FLASKS
American Foundry Equipment Co., New York City.
Damp Bros., Mfg. Co., Toronto, Ont.
Diamond Clamp & Flask Co., Richmond, Indiana.
I. Johnson & Son, Ltd., Toronto.

SNAP FLASK JACKETS
Damp Bros., Mfg. Co., Toronto, Ont.

STEEL BANDS
Damp Bros., Mfg. Co., Toronto, Ont.

TUMBLING BARRELS
R. MacDougall Co., Galt, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.

VALVES
Crane Limited, Montreal, Que.
Cleveland Pneumatic Tool Co., Cleveland, Ohio.

VENT WAX
United Compound Co., Buffalo, N. Y.

WASH RDDM FIXTURES
Crane Limited, Montreal, Que.

WELDING AND CUTTING SUPPLIES
Dominion Oxygen Co., Toronto, Ont.

WHEEL BARROWS
Sterling Wheelbarrow Co., Milwaukee, Wis.

INDEX TO ADVERTISERS

"ALL IS WELL THAT ENDS WELL" BUT A CASTING DOES NOT TURN OUT WELL WITHOUT THE PROPER START

Give Your Castings the Proper Start

Use the C. M. Miller Alloy Fluxes for All Metals

Make Perfect Castings every time
Instead of once in a while.
Let us help you
Lessen your losses
Eliminate your troubles and
Round up the orders!

Can save ten to twenty per cent. Coke.
Use fifteen per cent. more Scrap.
Pick out your Cupola in one-fourth the time.
Obtain one-third further deflection of test bar.
Less trouble from breakage in the rattlers.
Always save one ton of Iron outright in a 50-ton Heat.

Fluid and soft metal assured.
Less bricking and patching necessary.
Usually shortens the heat a minute a ton.
Xcessive shrinkage and porousness a thing of the past.

HOW?

Use Miller Keystone Cupola Flux.
Send for trial order. No pay unless satisfactory.

Fluxes For All Metals

Keystone Thermo Molybdenum Flux for Iron, Steel and Semi-Steel.
Tungsten Brand of Ladle Flux for Car Wheels, Chilled Rolls, etc.
Radioclarite for Brass, Bronze and Non-Ferrous Metals.
Pearlite for Aluminum. Special Radioclarite for Copper.

Send For Trial Order

C. M. MILLER

No Pay Unless Satisfactory

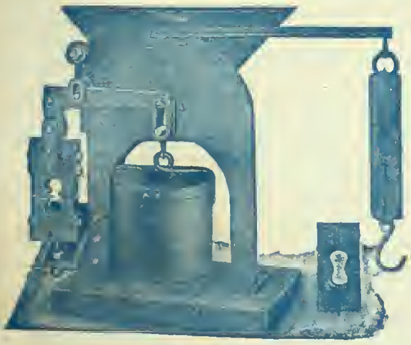
We produce all grades of Fluor Spar fromour own mines. Immediate delivery.

THE BASIC MINERAL CO., Box 276, N. S. Pittsburgh, Penna.

CANADIAN FOUNDRYMAN and Metal Industry News

Volume XIII. Number 5

Publication Office, Toronto
May, 1922

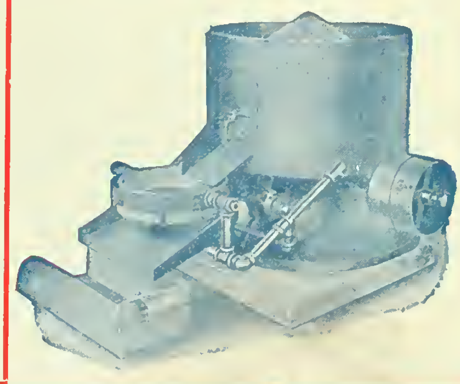


Wadsworth Core Testing Machine

Manufacturing Costs will take a decided drop

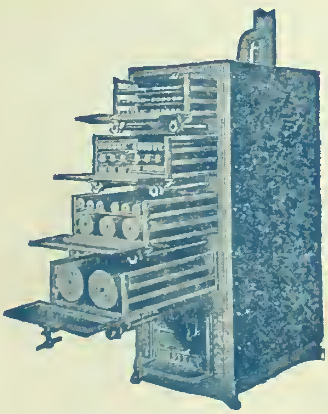
Present day conditions demand lowest possible selling price of a commodity.

You can reduce the price of your product without affecting your profit by manufacturing with



The Wadsworth Compounding Mill

WADSWORTH



The Wadsworth Core Oven

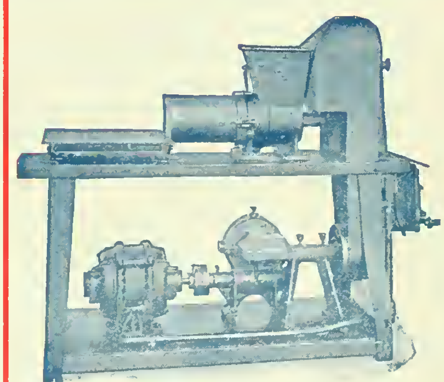
Complete

CORE ROOM OUTFITS

We have specialized on core making machinery and equipment for the last 20 years—and our product shows it.

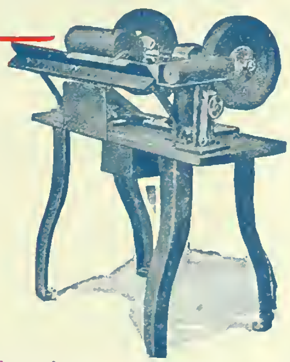
Wadsworth core machines are the only machines on the market on which a rodded core can be made. Tell us your needs and let us quote you.

The Wadsworth Core Machine & Equipment Co.
AKRON, OHIO

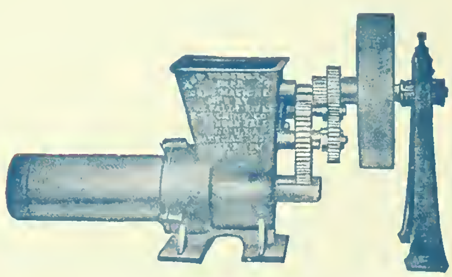


The Wadsworth Navy Type, Motor Driven, Core Making Machine, ⅜ to 7 in.

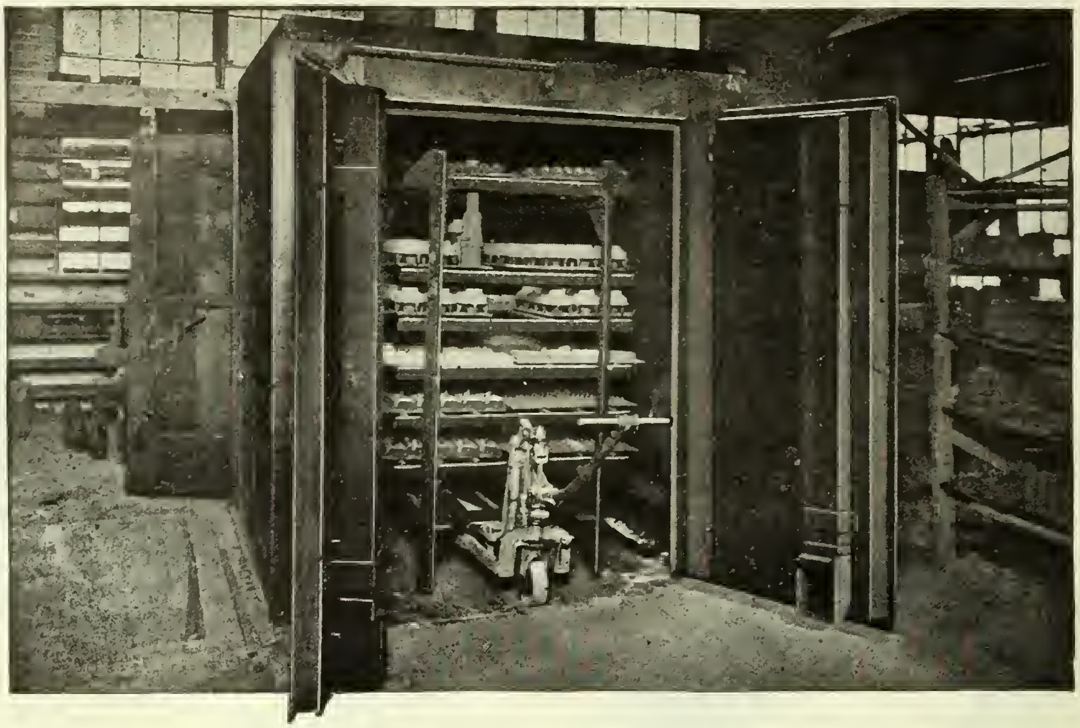
The Wadsworth No. 1 ⅜ to 3 in. Core Making Machine Hand or Power.



Wadsworth Core Cutting-off and Coning Machine.



The Wadsworth No. 3 Core Making Machine, ⅜ to 7 in.



To Oxygen Users
ANNOUNCEMENT

ONE of the largest organizations of its kind on the continent is created by the amalgamation of the extensive resources of

National Electro Products Limited

with

Dominion Oxygen Company Limited

This consolidation becomes effective immediately. The Dominion Oxygen Company Limited takes over the plants, patents, goodwill and contracts of the National Electro Products Limited, and will operate them under the name of the Dominion Oxygen Company Limited.

This union of the two companies will be of material advantage to all users of oxygen—it will effect stabilization of product — assure steady supply—and make possible important improvements in service.

It is sincerely hoped that the patronage given in the past to these two concerns individually will be extended to the new organization.

DOMINION OXYGEN COMPANY, LIMITED

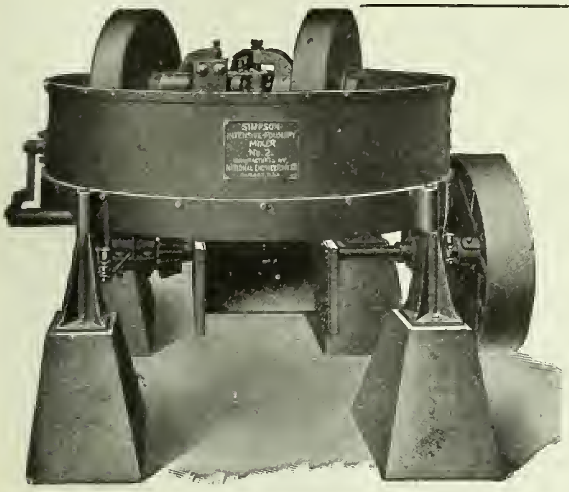
Operating the Welding and Cutting Gas Division of
PREST-O-LITE COMPANY OF CANADA, LIMITED

Hillcrest Park, Toronto.

Hamilton Merritton Montreal Quebec Shawinigan Falls
Welland Windsor Winnipeg

D29

"The Product of a Practical Foundryman"



THE SIMPSON INTENSIVE FOUNDRY MIXER

MADE IN FOUR SIZES

Economical and efficient for all kinds of sand mixtures in foundries producing gray iron, steel, malleable, aluminum and brass castings, also for mixing daubing for lining furnaces, cupolas, ovens, ladles, etc.

A few Canadian Users:

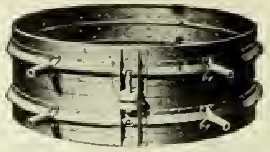
Dominion Coal Co., Ltd.
Canadian Westinghouse Co., Ltd.
*Dominion Foundries & Steel, Ltd.
Tallman Brass & Metal, Ltd.
*Jolliette Castings & Forgings, Ltd.
Boving Hydraulic & Engineering Co., Ltd.
National Farming Machinery, Ltd.
Canadian Electric Steel Co.
Canadian Pacific R. R.
*Crane, Ltd.
*Canadian Steel Foundries, Ltd.
Thos. Davidson Mfg. Co.
Dominion Bridge Co.
Robt. Mitchell & Co.
J. W. Cummings Mfg. Co., Ltd.
Ontario Specialties, Ltd.
Port Arthur Shipbuilding Co.
Canadian Ingersoll-Rand Co., Ltd.
*Dominion Iron & Steel Co.
Baldwins Canadian Steel Corp.
Electric Steel & Metals, Ltd.
Canadian National Railway.

What We Mean by Intensive Mixing of Foundry Sands

The Simpson Intensive Foundry Mixer has properly designed, adjustable mullers, of correct size and weight, which squeeze and knead the sand without breaking the grains. The plows very quickly amalgamate the various ingredients as well as heaping up the sand in the pathway of the mullers. This mixing action is so thorough that each grain of sand is quickly surrounded with the thinnest possible coating of new molding sand or clay or with compound, wet binder or oil, if that is used. Intensive mixing, then, is a thorough turning over, squeezing and kneading; possible only with a muller type mixer, and accomplished with maximum efficiency, including a considerable saving of labor, less new sand or binder and maintaining the highest quality of mixtures.

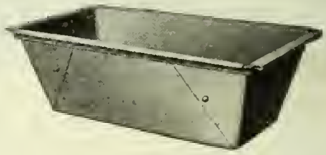
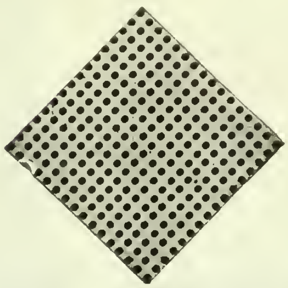
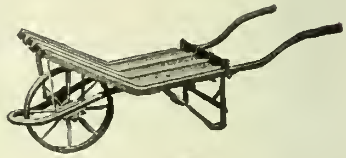
NATIONAL ENGINEERING CO.

549 W. Washington Blvd. CHICAGO, ILL.

Sterling
The Quality Plant



WE WILL BE AT THE
1922 FOUNDRYMEN'S CONVENTION

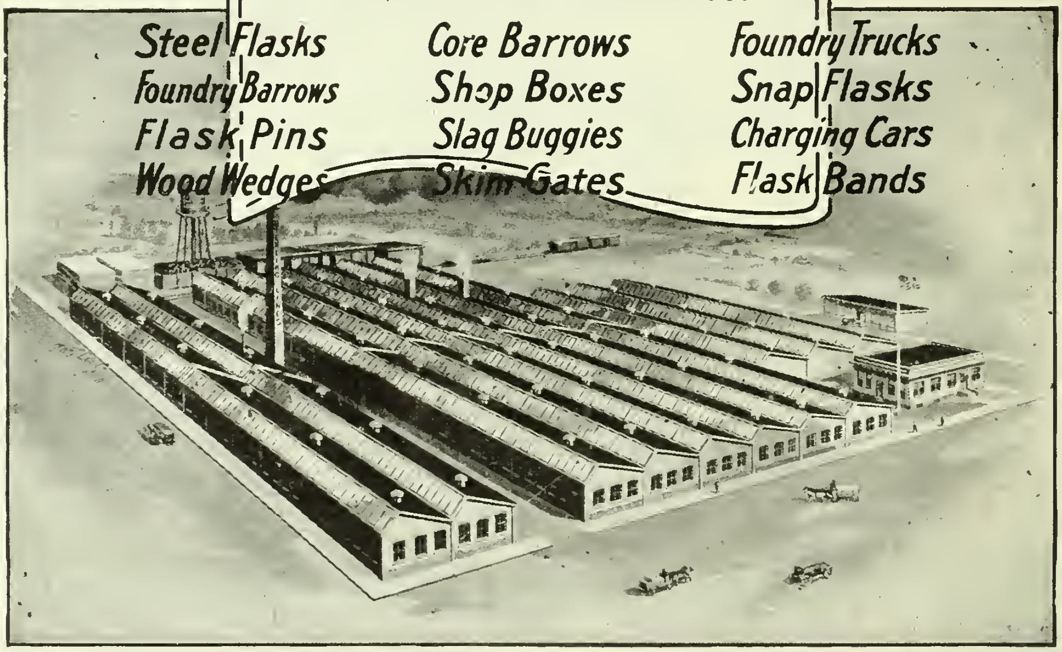
A cordial invitation is extended to all visitors to the Rochester Convention to call at our booth.

There will be an exhibit of our rolled steel flasks, and other products for foundry use, and, in addition, we will have a wheel-testing machine demonstrating the strength of a Sterling barrow wheel.

Our exhibit will interest you.

STERLING WHEELBARROW CO.

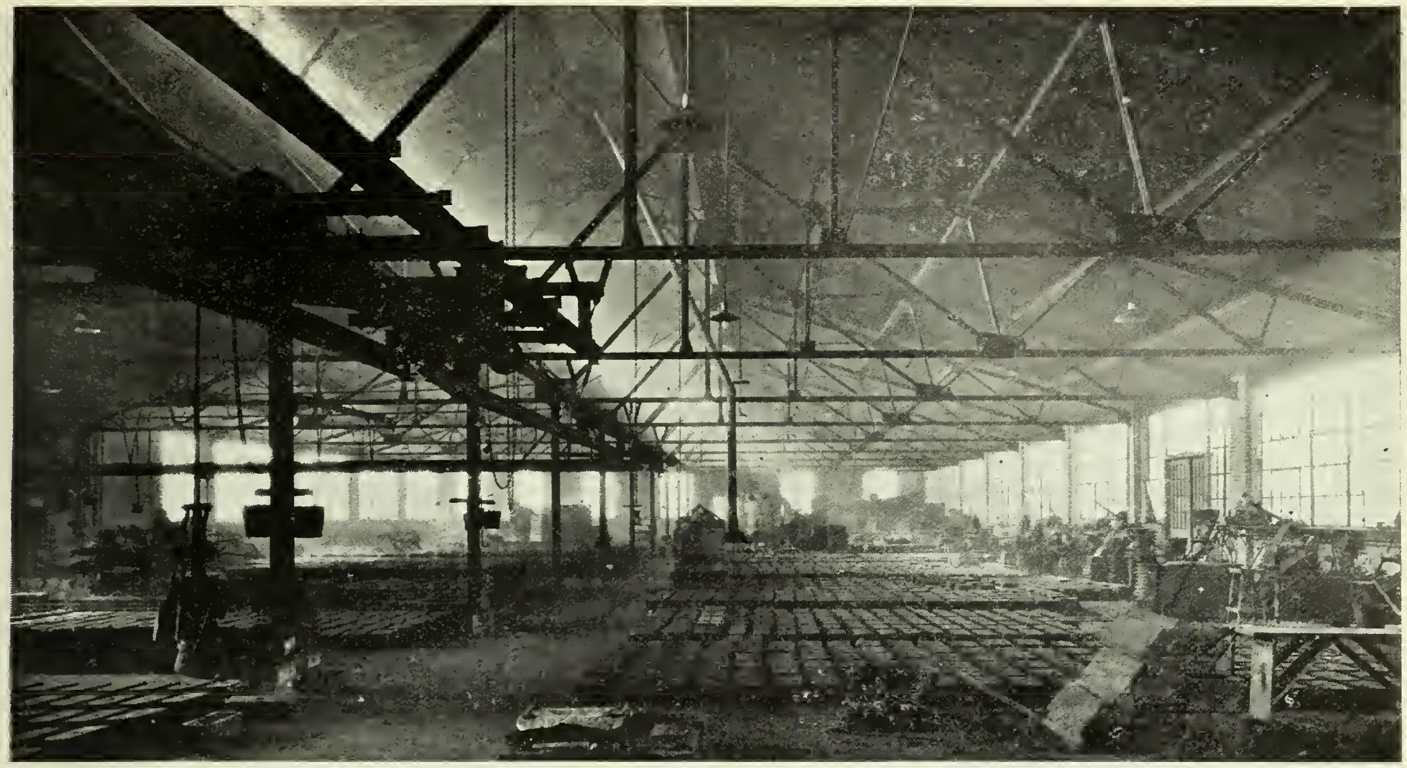




STERLING WHEELBARROW COMPANY

STERLING ON A WHEELBARROW MEANS MORE THAN STERLING ON SILVER

Milwaukee Wisconsin



Interior of Foundry of the Roberts & Mander Stove Company, Hatboro, Pa., designed built and equipped by the Austin Company

60% More for Your Building Dollar

Austin can increase the value of your building dollars. To-day you can build at minimum cost. Steel is going up. Material costs are low; the full working day has arrived. These elements have changed the building situation to-day. The Austin Method has brought further advantages.

Carefully kept cost records show that the Austin Company can to-day deliver to you 60% more building for a given amount of money than could have been delivered eighteen months or two years ago.

This reduction is due partly to reduced material and labor costs, but these lower basic costs are not the only elements by which Austin can safeguard your building investment. An Austin operation represents economy at every step.

Selecting site, purchase and layout of equipment, design of buildings and handling devices are some of the foundry construction problems which Austin foundry specialists are prepared to help you solve.

Our complete organization takes full responsibility for co-ordinating all details. Submit your problems to Austin engineers. Phone, wire or use the coupon. Consultation involves no obligation.

Foundry building of the Gartland McCarthy Foundry Co., Chicago, Ill., designed, built and equipped by The Austin Co

Plant of the U. S. Ball Bearing Company, Chicago, Ill. built by The Austin Company

THE AUSTIN METHOD

THE AUSTIN COMPANY, Cleveland
Foundry Engineers and Builders

CHICAGO NEW YORK
DETROIT DALLAS
PITTSBURGH ST. LOUIS
PHILADELPHIA

THE AUSTIN CO. OF CALIFORNIA, LOS ANGELES

AUSTIN

ENGINEERING BUILDING EQUIPMENT

C. F. May

THE AUSTIN COMPANY, CLEVELAND

Gentlemen: We would be interested in having a copy of your circular "Facts You Should Have Before You Build Your New Building." It is understood that this request places us under no obligation.

We contemplate the construction of a........building
........wide........long........stories high.

Firm........................

Individual........................

Address........................

TABOR
3-inch Plain Jarring Machine For Small Molds And Medium Sized Cores

3" Tabor Jarring Machine with 12" x 14" Table

A Necessity in Every Foundry

SEND FOR BULLETIN M-J-P

THE TABOR MFG. COMPANY

6225 State Road, Tacony, Philadelphia, U.S.A.

"LACKO" PARTING

A high grade Parting for the Foundry. Manufactured from the best quality tripoli and oil which has absolute water-resisting qualities. Will stand the test.

Eliminates Defective Castings

Its use will result in a saving from defective castings. Let us ship you a trial barrel on approval for test.

Delivered Price 4c. lb. For 375 lb. bbl.

Reliable Parting Company

West Liberty, Ohio, U.S.A.

GUESSWORK VS. SCIENCE

Many foundry owners, managers, foremen, molders and others connected with foundries have received but little schooling, as they had to help support the family at an early age.

Others, perhaps, did not need to help but as they were going to learn a trade, they and their friends thought it unnecessary to continue in school because of the mistaken idea that a tradesman did not need education.

McLAIN'S SYSTEM affords foundrymen an opportunity to obtain an education covering the science of combustion, so essential in the manipulation of the cupola and common sense application of the chemistry of iron and steel. In other words, the practical metallurgy of iron and steel foundry practice plus an accumulation of metallurgical facts that point the way to success for all men connected with the foundry business.

Many foundry engineers, efficiency men, metallurgical engineers, chemists and others have adopted McLAIN'S SYSTEM as standard authority. Note the following:

> "Please accept my thanks for the courteous treatment accorded me while taking your Iron Foundry Course. The practical 'horse sense' information in regard to foundry and cupola practice is just what the metallurgist needs and has already proven itself of great value to me.
>
> "We are at the present time making some very heavy castings which are to be subjected to high stresses, and of course high strengths are necessary. The castings are for a special machine for making truck frames which we are building for the A. O. Smith Corporation, of your city. The arbitration bars are giving a transverse strength of about 4,000 pounds with a deflection of .16 to .18 inches. Tensile strengths are from 35,000 to 38,000 pounds. We have been able to accomplish this only by your assistance in improving our melting practice and the use of steel scrap. In other words, properly melted semi-steel."
>
> (Name upon request)

McLAIN'S SYSTEM, Inc.

700 Goldsmith Bldg., Milwaukee, Wis.

McLain's System, Inc., 700 Goldsmith Bldg., Milwaukee, Wis.
I am interested in STEEL
Crucible ( )
Converter ( )
Electric ( )
Open Hearth ( )
Semi-steel ( )
Gray Iron ( )
Cupola Practice ( )
Blue Print Reading ( )
Name........................
Address........................
Firm........................
Position........................
5-1-22

Member of the
"Audit Bureau of Circulations"

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Established 1909
Published Monthly

Foundrymen to Meet each Other at Rochester N.Y.

American, Canadian, British, French and Belgian Foundrymen Will Convene to Discuss Foundry Problems and View the Latest Innovations in Foundry Equipment June 5-9

AFTER an unbroken quarter of a century of successful annual conventions the first of which was held at Philadelphia in 1896 and the twenty-fifth at Columbus, Ohio, in 1920, and after allowing the twenty-sixth year to lapse, the American Foundrymen's Association will begin the first lap of the second quarter, at Rochester, N. Y., on June 5th next.

The value of these conventions and the benefits to be derived are inestimable. The first one, while only a convention of foundrymen, proved its worth and paved the way for a better one the following year. Each year the convention held its own with the previous one and always had something added which made it a better one, until the year 1906 when a new innovation was introduced in the form of a foundry exhibit. This was held in conjunction with the convention for the first time in the Central Armory, Cleveland, Ohio, in the spring of 1906. This also was a success and the conventions continued year after year to gain in popularity, until the final one at Columbus, in 1920, in which both the convention and the exhibit surpassed all previous ones in number of exhibits as well as attendance. Thus ended the first quarter of a century of a most successful annual event. A rest seemed now to be in order, and a few months have been added to the usual time allowance for preparation with the result that the convention and exhibition of the American Foundrymens' Association together with that of the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers will be held at Rochester, N. Y., during the week of June 5-9, in the million dollar buildings of Rochester's Industrial Exposition, an annual event which takes place during the month of September.

These buildings and grounds are ideally located and are most suitable for exhibition purposes. The day is gone when armory buildings answer the purpose—nothing but real exhibition facilities count at a modern foundrymens' convention. The three main exhibition buildings shown in the illustration contain nearly one hundred thousand square feet of floor space, all connected and all on the ground floor. Besides these the foundrymen will use different other ones, particularly the auditorium at the main entrance, and the restaurant building.

Rochester as a City

Rochester, N. Y., is the county seat of Monroe County, located on Lake Ontario with a natural port on the Genesee River and is also situated on the New York State "1,000-ton" Barge Canal with a magnificent harbor, extending to within three hundred yards of Main Street.

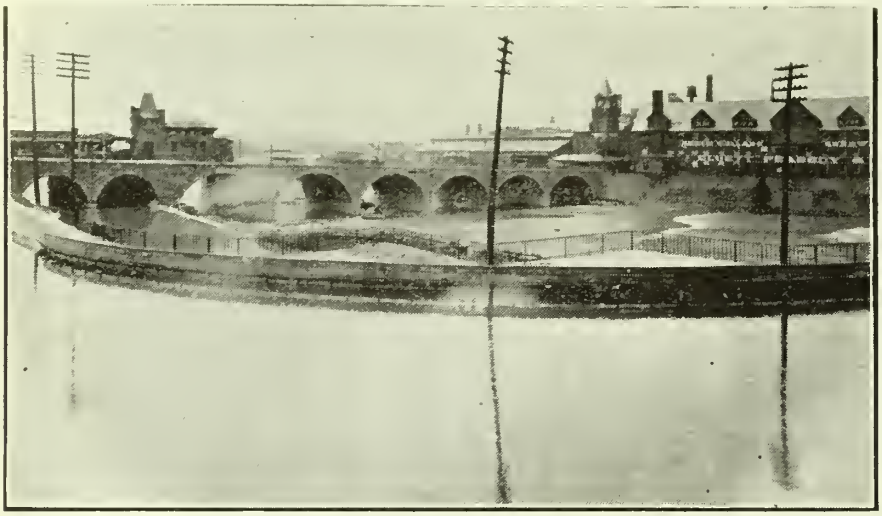
Rochester was settled in 1810 and has enjoyed steady prosperity ever since. The original city was located seven miles from the mouth of the Genesee River but has since extended its boundaries over the entire seven mile stretch of river until now what was formerly the port of Charlotte is incorporated within the city limits. The population of the city according to the census of 1920 is 295,750, making it the third largest city in the State of New York and the twenty-second in the United States. The city, unexcelled in charm and beauty is set in the marvelously fertile valley of the Genesee river.

Transportation

As a manufacturing city, Rochester is exceptionally favored, its transportation facilities comparing most favorably with those of any city on the continent. In addition to its lake, river, and canal accommodation, it is served by five steam railroads, the New York Central and Hudson River; the Erie; the Lehigh Valley; the Western New York and Pennsylvania, and the Buffalo, Rochester and Pittsburgh, being one of the terminals of the last named road. It is al-

Buildings and grounds of Rochester's Industrial Exposition, where the American Foundrymen's Convention will be held.

so served by a trolley system owned by the New York State Railways which operate 150 miles of trolley road inside the city. There are also five electric roads carying passengers, express and freight into the city. The old Erie canal also passes through the city and is quite an imposing sight. It had to cross the river and being on a much higher level was carried over in an open-topped aqueduct 848 feet long with a channel 45 feet wide and supported by nine arches.



Where the aqueduct crosses the Genesee River at Rochester. The aqueduct carries the waters of the New York State Barge Canal and has long been regarded as one of the engineering marvels of the great water-way. The aqueduct is in the foreground and Court Street bridge in the background. The Lehigh Valley tracks skirt the western shore of the River and the Erie tracks the eastern shore. The stations of both railroads are shown in the further background beyond the bridge. The New York Central, The Western New York and Pennsylvania, and the Buffalo, Rochester and Pittsburg Railroads also enter Rochester.

Manufacturies

The manufacturing interests of Rochester are large. There are 1,650 factories turning out 350 commodities. The city leads the world in the production of a large number of articles, including cameras, camera supplies, optical goods, check protectors, thermometers, filing devices and office systems, enameled steel tanks, soda fountain fruits and syrups. It also leads the country in the production of high class ivory buttons and produces 60 per cent. of the typewriter and carbon ribbon made in America. It ranks fourth in the United States in the production of shoes and men's clothing. The annual output of shoes in 1919 was $55,000,000 from the 56 factories of the city. Rochester is a large machinery centre, having several large plants devoted to the manufacture of machines and tools. There are also several automobile factories, and incidentally there are thirty foundries.

Mercantile

Because of the high class of labor employed in Rochester in the precision industries which make up a large part of its manufacturing interests, Rochester has a large number of well-paid workers. As a result retail business is done on a large scale and the city boasts of five flourishing departmental stores as well as many retail stores confined to one or more lines. The trading radius for retailers extends for thirty miles in all directions from the city.

Nursery Business

An industry which might seem unimportant to the unthinking person is that of the nursery, but it is a big business and Rochester is the headquarters for all the nursery business in the United States. A view of the nurseries when in blossom is a sight never to be forgotten. Being in the centre of the nursery country the residential sections of Rochester are embellished with trees and shrubs and the city exhibits much pride in maintaining a neat appearance.

Rochester lies in the centre of a rich farming district and surrounding the city are many beauty spots for the sightseer. Monroe county in which Rochester is situated has a population, including that of the city, of 352,000.

The surrounding country has no large settlements to compete with Rochester, the nearest being Syracuse, 80 miles distant to the east, and Buffalo, 70 miles distant to the west. The territory surrounding the city is mainly farming land. Much of it is devoted to truck gardening which produces a large revenue.

Western New York is a fruit growing country and this is one of the chief industries of the rural districts. Canning factories are numerous and much attention is paid to the nursery and seed business. Wholesalers in all lines have customers as far distant as 60 to 70 miles who are given a twenty-four hour service from Rochester. Rochester products are sold in all parts of the world wtih the slogan, "Rochester Made Means Quality."

Th Genesee River is itself a thing of beauty. Within the city limits it has three falls with a drop of 267 feet and developing fifty thousand horse power.

The city maintains a large park system. The Park Commission was created in 1888 and the park system has been enlarged year by year through purchases and gifts so that now the total area of park territory is 1,605 acres. The five largest parks in their order are: Durand-Eastman, located on the lake shore on the northern edge of the city; Genesee Valley Park, located on the south of the city on both sides of the Genesee River; Seneca Park, to the north of the city and east of the river;

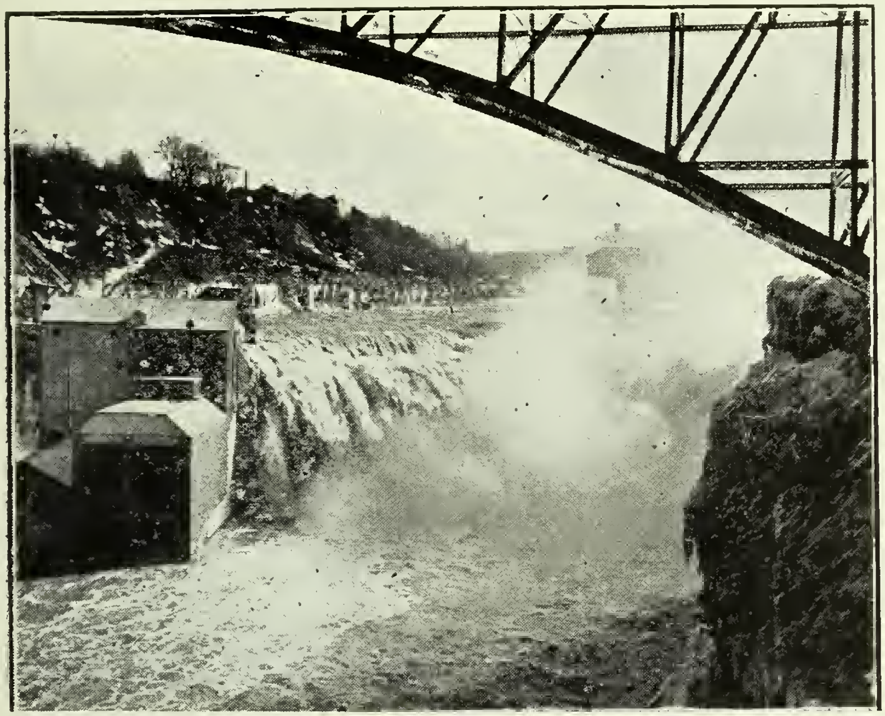
A view in beautiful Highland Park, which as an aboretum is the second most complete in the United States. The observatory on the highest point is dedicated to the children of Rochester. Lamberton Conservatory, the last word in indoor plant growing, is also located in this park. At the time of the Convention, Highland Park will be in all its glory.

Maplewood Park, to the north of the city and west of the river; Highland Park, in which is located one of the large reservoirs. Highland Park also contains one of the finest arboretums in the country. All have improved roads and playgrounds, tennis courts and golf courses. There are also collections of animals and birds in several of the parks and boating and bathing facilities have been provided in the parks which front on the river and lake. Exposition Park with 42 acres, centrally located, is a Million Dollar Show spot for exhibitions, horse shows, and other public gatherings.

Here the foundrymen's convention will be held.

Public Works

The city owns its own waterworks system, bringing its supply from Hemlock and Canadice Lakes, thirty miles south of Rochester, through three large conduits. Electricty and gas are provided by the Rochester Gas and Electric Corporation, which owns a large percentage of the water rights in the Genesee River and which has an exclusive franchise for providing the city with these commodities.



The famous lower falls of the Genesee River. This fall is not as high as those of Niagara, but it is one of the show places of the city and furnishes vast water power for the many industries of Rochester. The girders are part of the famous Driving Park Avenue bridge, one of the longest single span bridges in the country.

Newspapers

There are five daily newspapers, Democrat and Chronicle, Herald, Times-Union, Post Express and Abendpost, and a large number appearing less frequently.

The police force numbers 377 uniformed men.

Rochester has a public library with six branches circulating 75,000 volumes. The city also has the Reynolds Library with 55,800 volumes. These are in addition to the libraries maintained by the school system and university.

The Chamber of Commerce is a flourishing institution of 4,200 members with Roland B. Woodward as general secretary. It plays an important part in the life of the city and has a new building of its own, costing nearly $1,000,000 into which it moved October, 1917. It has completed plans for an addition which will more than double its space.

Government

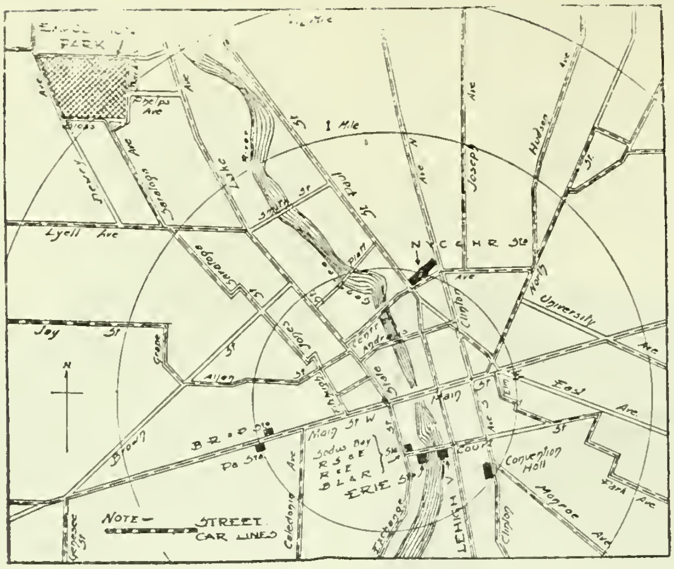
The city is governed by a Mayor and cabinet, by the Common Council with one representative from each of the twenty-four wards. Elections are held every second year.

The Board of Education which numbers seven members, controls the city school system. It maintains 53 buildings with as many principals, and during 1920 there were approximately 1,498 teachers with 44,091 registered pupils. The expenditures of the Board for 1920 were $4,107,011.74. There are four high schools, East High, West High and Charlotte High and Kodak High, also two Junior High schools, Washington Junior High and Jefferson Junior High. There are also thirty-three parochial schools and many private institutions, including four academies, two for girls and two for boys; one large institution for instruction of deaf mutes. The Rochester Athenaeum and Mechanics Institute was founded in 1885 as a free drawing school and has expanded year by year so that now it gives instruction in practical arts and sciences to 2,738 pupils and ranks fourth among the trade schools of the country. The University of Rochester was founded in 1850 and has beautiful grounds in the eastern part of the city. It has a faculty of 60 instructors with 703 students and a library of 76,000 volumes. There is also the Rochester Theological Seminary, Baptist, founded in the same year. It has a faculty at present of seventeen with more than 100 students and a library of 42,900 books. St. Bernard's Theological Seminary, Catholic, is located in the northern section of the city, occupying spacious grounds. It was founded in 1893 and has now thirteen professors, 235 students and a library of 15,000 volumes.

There are thirteen banks in Rochester as follows:—

Central Bank.
Lincoln Alliance Bank.
Merchants Bank.
Traders National Bank.
Genesee Valley Trust Co.
Rochester Trust & Safe Deposit Co.
National Bank of Commerce.
Security Trust Company.
Union Trust Co.
Monroe County Savings Bank.
Rochester Savings Bank.
East Side Savings Bank.

Auditorium at Exposition Park, Rochester, where the Technical sessions will be held.



Map of Rochester, showing different Railway Stations and the Exposition Park.

Mechanics Savings Bank.

The total bank clearings in 1920 were $594,398,278.21.

So much for Rochester as a city.

To the Convention

The illustration here shown will make it easy to locate the Exposition as the various railway stations are shown. As previously stated the various railways of the United States and Canada have arranged special rates on their regular trains. The rate will be single fare and one half for round trip. It will be necessary to be identified as a delegate to the convention in order to get this rate and it would be wise to arrange for this as early as possible.

Unfortunately the steamers of the Canada Steamship Company, which make regular runs to the Port of Rochester do not begin their summer season until Saturday June 11, following the close of the convention. The steamers plying between Toronto and the Niagara River are already running and this makes a delightful trip. It is a short run from Lewiston to Rochester after leaving the boat. However all Canadian railways lead to Rochester.

On arriving at the grounds in Rochester the visitor will enter building No. 3, shown in the lay-out sketch, where he will register his name. If he is a Canadian, and is not ashamed of it he will also call at booth No. 338, which as will be seen is directly opposite the registration booth. This is Canadian Foundryman's booth, and here he will be welcomed. Our chairs and our desk and writing material will be at his disposal at all times as we want all our friends to call and shake hands with us and make themselves right at home during the entire week.

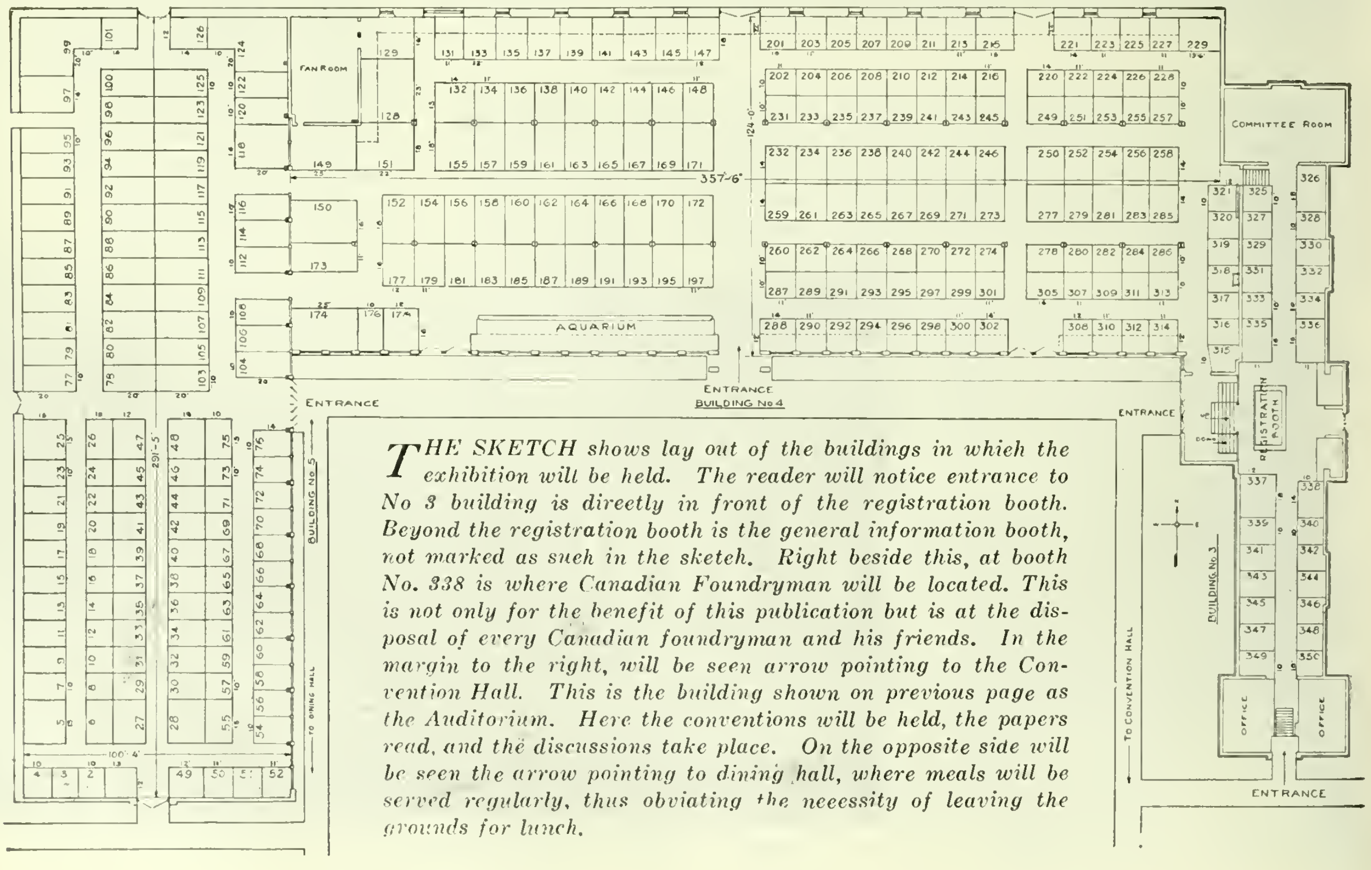
The Programme

At 10 a.m. the convention will open and remain open throughout the week. This will be in the five buildings shown in the sketch. Here everything imaginable in the way of foundry equipment and supplies will be displayed, and the visitor may spend whatever portion of his time he chooses in inspecting these.

List of Exhibitors

Among those who have engaged booths for the exhibit are the following:

- Acheson Graphite Co., Niagara Falls, N. Y.
- Air Reduction Sales Co., New York City, N. Y.
- Ajax Metal Co., Philadelphia, Pa.
- Allan Manufacturing & Welding Co., Buffalo, N.Y.
- American Foundry Equipment Co., New York City, N. Y.
- American Woodworking Machinery Co., Rochester, N. Y.
- Arcade Manufacturing Co., Freeport, Ill.
- Armstrong-Blum Mfg. Co., Chicago, Ill.



THE SKETCH shows lay out of the buildings in which the exhibition will be held. The reader will notice entrance to No 3 building is directly in front of the registration booth. Beyond the registration booth is the general information booth, not marked as such in the sketch. Right beside this, at booth No. 338 is where Canadian Foundryman will be located. This is not only for the benefit of this publication but is at the disposal of every Canadian foundryman and his friends. In the margin to the right, will be seen arrow pointing to the Convention Hall. This is the building shown on previous page as the Auditorium. Here the conventions will be held, the papers read, and the discussions take place. On the opposite side will be seen the arrow pointing to dining hall, where meals will be served regularly, thus obviating the necessity of leaving the grounds for lunch.

Asbury Graphite Mills, Asbury, N. J.
E. C. Atkins & Co., Indianapolis, Ind.
Austin Company, Cleveland, Ohio.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Balbach Smelting & Refining Co., New York City, N. Y.
Badger Tool Co., Beloit, Wis.
C. O. Bartlett & Snow Co., Cleveland, Ohio.
Basic Mineral Co., Pittsburgh, Pa.
Bastian-Blessing Co., Chicago, Ill.
Bausch & Lomb Optical Co., Rochester, N. Y.
Beardsley-Piper Co., Chicago, Ill.
Beaudry & Co., Inc., Boston, Mass.

W. R. BEAN
President American Foundrymen's Association

Bethlehem Steel Co., Bethlehem, Pa.
S. Birkenstein & Sons, Inc., Chicago, Ill.
Black Diamond Saw & Machine Wks., Natick, Mass.
Blystone Manufacturing Co., Cambridge, Spgs., Pa.
Bonnot Co., Canton, Ohio.
Carborundum Co., Niagara Falls, N. Y.
Frank D. Chase, Inc., Chicago, Ill.
Chicago Crucible Co., Chicago, Ill.
Chicago Pneumatic Tool Co., New York City, N. Y.
Chas. J. Clark Blastmeter Co., Gladbrook, Iowa.
Clark Tructractor Co., Buchanan, Mich.
Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Cleveland Pneumatic Tool Co., Cleveland, Ohio.
Clipper Belt Lacer Co., Grand Rapids, Mich.
Thomas E. Coale Lumber Co., Philadelphia, Pa.
Cochrane-Bly Co., Rochester, N. Y.
F. A. Coleman Co., Cleveland, Ohio.
Combined Supply & Equipment Co. Buffalo, N. Y.
Davenport Machine & Foundry Co., Davenport, Iowa.
Dayton Pneumatic Tool Co., Dayton, Ohio.
Debevoise Anderson Co., New York City, N. Y.
Wm. Demmler & Bros., Kewanee, Ill.
Detroit Electric Furnace Co., Detroit, Mich.
Henry Disston & Sons, Philadelphia, Pa.
Joseph Dixon Crucible Co., Jersey City, N. J.
Doehler Die Casting Co., Brooklyn, N.Y.
Electric Furnace Co., Alliance, Ohio.
Electro Refractories Corp., Buffalo, N.Y.
Federal Malleable Co., West Allis, Wis.
Foundry Equipment Co., Cleveland, Ohio.
General Electric Co., Schenectady, N. Y.
Globe Iron-Crush & Shot Co., Mansfield, Ohio.
Robert Gordon, Inc., Chicago, Ill.
Grimes Molding Machine Co., Detroit, Mich.
Hanna Engineering Works, Chicago, Ill.
Clement Hardy Co., Chicago, Ill.
R. G. Haskins Co., Chicago, Ill.
Hayward Co., New York City, N. Y.
Herman Pneumatic Machine Co., Pittsburgh, Pa.
High Speed Hammer Co., Rochester, N. Y.
Hill & Griffith Co., Cincinnati, Ohio.
Hoevel Manufacturing Corp., Jersey City, N. J.
Holcroft & Co., Detroit, Mich.
Hyatt Roller Bearing Co., New York City, N. Y.
Independent Pneumatic Tool Co., Chicago, Ill.
Industrial Controller Co., Milwaukee, Wis.
Ingersoll-Rand Co., New York City, N. Y.
International Molding Machine Co., Chicago, Ill.
Spencer Kellogg & Sons, Inc., Buffalo, N. Y.
Kuehnle, Inc., Philadelphia, Pa.
H. M. Lane Co., Detroit, Mich.
Lava Crucible Co., Pittsburgh, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Link Belt Co., Chicago, Ill.
David Lupton's Sons Co., Philadelphia, Pa.
J. S. McCormick Co., Pittsburgh, Pa.
Macleod Co., Cincinnati, Ohio.
Malleable Iron Fittings Co., Branford, Conn.
Mechanical Appliance Co., Milwaukee, Wis.
Menefee Foundry Co., Fort Wayne, Ind.
Metal & Thermit Corp., New York City, N. Y.
Michigan Smelting & Refining Co., Detroit, Mich.
Mills, Rhines, Bellman & Nordhoff, Toledo, Ohio.
Modern Pouring Device Co., Pt. Washington, Wis.
Moline Iron Works, Moline, Ill.
Monarch Engineering & Mfg. Co., Baltimore, Md.
National Engineering Co., Chicago, Ill.
Wm. H. Nicholls Co., Inc., Brooklyn, N. Y.
Norma Company of America, Long Island City, N. Y.
Northern Blower Co., Cleveland, Ohio.
S. Obermayer Co., Chicago, Ill.
Osborn Mfg. Co., Cleveland, Ohio.
Ohio Body & Blower Co., Cleveland, Ohio.
George Oldham & Sons Co., Baltimore, Md.
Oxweld Acetylene Co., Newark, N. J.
Pangborn Corp., Hagerstown, Md.
J. W. Paxson Co., Philadelphia, Pa.
Charles E. Pettinos, New York City, N. Y.
Geo. F. Pettinos, Philadelphia, Pa.
Pickands, Brown & Co., Chicago, Ill.
Pittsburgh Electric Furnace Corp., Pittsburgh, Pa.
Porcelain Enamel & Mfg. Co., Baltimore, Md.
Portage Silica Co., Youngstown, Ohio.

C. E. HOYT
Secretary American Foundrymen's Association.

Henry E. Pridmore, Inc., Chicago, Ill.
Racine Tool & Machine Co., Racine, Wis.
Richards-Wilcox Mfg. Co., Aurora, Ill.
Rogers, Brown & Co., Cincinnati, Ohio.
P. H. & F. M. Roots Co., Connersville, Ind.
Royer Foundry & Machine Co., Wilkes-Barre, Pa.
Sabin Machine Co., Cleveland, Ohio.
Safety Equipment Service Co., Cleveland, Ohio.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Simonds Mfg. Co., Fitchburg, Mass.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Werner G. Smith Co., Cleveland, Ohio.
Spencer Turbine Co., Hartford, Conn.
Sterling Wheelbarrow Co., West Allis, Wis.
W. F. Stodder, Syracuse, N. Y.
Sullivan Machinery Co., Chicago, Ill.
Superarc Welding Machine Co., Detroit, Mich.
Syracuse Supply Co., Syracuse, N. Y.
Tabor Mfg. Co., Philadelphia, Pa.
W. P. Taylor Co., Buffalo, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Truscon Steel Co., Youngstown, Ohio.
United Compound Co., Buffalo, N. Y.

United States Graphite Co., Saginaw, Mich.
United States Silica Co., Chicago, Ill.
Vibrating Machinery Co., Chicago, Ill.
Wadsworth Core Machine & Equipment Co., Akron, Ohio.
H. L. Wadsworth, Cleveland, Ohio.
J. D. Wallace & Co., Chicago, Ill.
Wayne Oil Tank & Pump Co., Fort Wayne, Ind.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Westinghouse Traction Brake Co., Pittsburgh, Pa.
White & Bro., Inc., Philadelphia, Pa.
Whitehead Bros. Co., Buffalo, N. Y.
Whiting Corporation, Harvey, Ill.
E. J. Woodison Co., Detroit, Mich.
T. B. Wood's Sons Co., Chambersburg, Pa.
Young Bros. Co., Detroit, Mich.

Sessions

The sessions where the papers will be read and where discussions on the various topics of foundry interest contained in the papers will form a most instructive and interesting part, will be held in the Auditorium building, erroneously designated as the convention hall in the sketch.

These sessions will be held in different rooms at the same time so that those interested in any special subject will attend the one which suits him. It would be impossible to cover all the ground in the time allowed if only one session took place at a time.

Following is the order in which the sessions will be held.

Monday, June 5

10 a. m. Opening of exhibits. Registration.

2 p.m. Joint opening session, American Foundrymen's Association and the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers.

Tuesday, June 6

9.30 a.m. International Session.

Annealing of Gray Iron, by J. F. Harper and R. S. McPherron, Allis Chalmers Co., Milwaukee, Wisconsin.

European versus American Molding Machine Practice, by E. Ronceray, President, Societe Anonyme des Establissements, Ph. Bonvillian and E. Ronceray, Paris.

Making Typewriter Frames in a Belgium Foundry, by Joseph Leonard, President, Association Technique de Fonderie de Liege, Herstal, Belgium.

Destruction and Reconstruction of French Foundries, A Memoir submitted by the Association Technique de Fonderie de France.

Cupola Melting Tests with Mixtures Changing During Run, by Richard Moldenke, Watchung, N. J.

American vs. British Cast Iron, by F. J. Cook, Rudge-Littley Ltd., Annual Exchange Paper of the Institution of British Foundrymen.

Tuesday, June 6

2 p.m "Side Blow Converters for Steel Foundries," by T. Levoz, Association Technique de Fonderie de France.

"Tests with Cerium as a Deoxidizer and Desulphurizer in Red Brass, Cast Iron and Converter Steel," by L. W. Spring, Crane Company, Chicago.

"A Study of the Change of Grain Size of Silica Sand Through the Constant Addition of Clay," by R. J. Doty, Sivyer Steel Casting Co., Milwaukee, Wisconsin.

"Accurate Control of Analyses in Acid Electric Steel Furnaces," by A. C. Jones, Electric Steel Co., Chicago.

"A Managerial Study of Oxy-Acetylene Cutting and Welding in Foundries," by G. O. Carter, Consulting Engineer, The Linde Air Products Co., New York City.

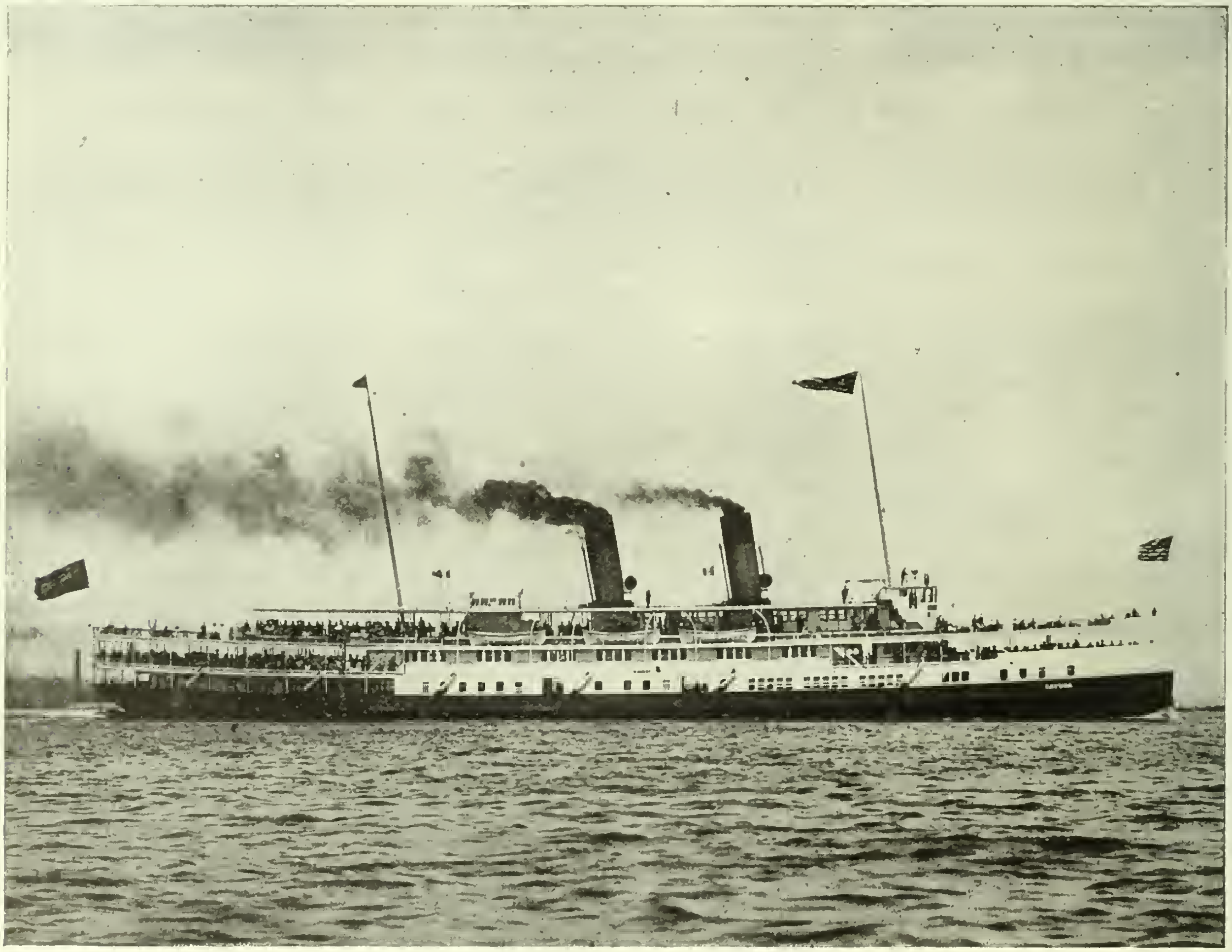
Tuesday, June 6

2 p.m. "Technical Control of McCook Field Foundry," by E. H. Dix, Jr., McCook Field, Dayton.

"Selection of Fuels and Furnaces for Melting Copper and Brass Alloys," by T. H. A. Eastick.*

"Porosity of Non-Ferrous Metals," by R. R. Clarke, Pittsburg, Pa.

"An investigation of 'Segregation' with a view to Preventing its Occurrence in Castings made of High-Lead



Canada Steamship Company's SS. "Cayuga." Finest passenger steamer on the lakes, chartered for the Foundrymen's excursion, June 8.

Bronze," by R. E. Lee and F. B. Trace, Allegheny College, Meadville, Pa.

"Brass Forgings," by C. G. Heiby, Mueller Metals Co., Port Huron, Michigan.

*Deceased.

Wednesday, June 7

9.30 a.m. Steel Session.

"A New Electric Furnace," by R. Sylvany, Association Technique de Fonderie de France.

"Impact Tests on Steel," by F. C. Langenburg, Watertown Arsenal, Watertown, Mass.

"Manufacture of Manganese Steel in the Electric Furnace," by J. Howe Hall, Taylor-Wharton Iron and Steel Co., High Bridge, N. J.

"Progress in Open Hearth Process," by Willis McKee of Arthur G. McKee & Co., Cleveland, Ohio.

Report of Committee on Specification for Steel Castings.

Wednesday, June 7

9.30 a.m. Non-Ferrous Session.

"Two-Part Castings Made in Three-Part Molds," by W. H. Parry, Brooklyn, New York.

"Use of Secondary Aluminum Ingot in Foundry Practice," by W. M. Weil, National Smelting Co., Cleveland, Ohio.

"Aluminum and Aluminum Alloy Melting Furnaces," by R. J. Anderson, Bureau of Mines, Pittsburgh, Pa.

"Melting Aluminum for Rolling into Sheets," by J. A. Lange, Western Springs, Illinois.

Wednesday, June 7

9.30 a.m General and Gray Iron Session.

"A Study of the Weight of Iron Castings," by J. D. Wise, University of Illinois, Urbana, Illinois.

"Electrically Heated Metal Patterns," by C. A. Cremer, Westinghouse Electric and Mfg. Co., E. Pittsburgh, Pa.

"Flask Equipment for Molding Machines," by Arnold Lenz, Saginaw Products Co., Saginaw, Michigan.

"Design of Geared Ladles," by A. W. Gregg, Whiting Corporation, Harvey, Illinois.

"Investigations Relative to Insulated Core Oven Design and Performance," by C. F. Mayer, Ohio Body and Blower Co., Cleveland, Ohio.

"Electric Cranes in Foundry Service," by A. H. McDougall, Whiting Corporation, Harvey, Illinois.

"Technical School Foundries," by J. D. Hoffman and R. E. Wendt, Purdue University, Lafayette, Indiana.

Report of A.F.A. Sub-Committee on Specifications for Cast Iron Wheels.

"Memorial on Corrosion of Cast Iron," by H. Y. Carson, American Cast Iron Pipe Co., Birmingham, Alabama.

Report of Committee on Specifications for Gray Iron Castings.

Wednesday, June 7

2 p.m. Industrial Relations Session.

Report of A.F.A. Committee on Safety, Sanitation, and Fire Protection.

"Cycles of Depression and Their Prevention," by Ernest F. DuBrul, General Manager, National Tool Builders' Association, Cincinnati, Ohio.

"Prevention of Waste in Industry," by L. W. Wallace, Executive Secretary, The Federated American Engineering Societies, Washington, D. C.

"Time Study and Job Analysis in the Foundry," by A. J. Kramer, Deering Works, International Harvester Co., Chicago.

"Eye Protection and Safe Clothing in the Foundry," by Buell W. Nutt, The Safety Equipment Service Co., Cleveland, Ohio.

Thursday, June 8

9.30 a.m. Molding Sand Research Session.

"The Preparation of Steel Foundry Sands," by S. H. Cleland National Engineering Co., Chicago.

"Establishing a Method of Testing for Green Bonded Strength," by R. J. Doty, Sivyer Steel Casting Co., Milwaukee, Wis.

"Significance of Screen Test of Molding Sand," by H. A. Schwartz, National Malleable Casting Co., Cleveland, Ohio.

Reports of Joint Committee of American Foundrymen's Association and National Research Council Committees on Molding Sand Research.

Friday, June 9

9.30 a.m. Malleable Cast Iron Session, followed by General Business session.

"The Manufacture and Properties of Refractories for Air Furnaces," by C. E. Bales, Louisville, Fire Brick Co., Highland Park, Kentucky.

"The Behaviour of Fire Brick in Malleable Furnace Bungs," by H. G. Schurecht, Bureau of Mines, Columbus, Ohio.

"A European View of the Malleable Problem," by T. Levoz, Association Technique de Fonderie de France.

"Use of Carbon Dioxide Recorders in Controlling Combustion of Powdered Coal," by D. M. Scott, the T. H. Symington Co., Rochester, N. Y.

"Use of Pulverized Coal for Malleable Foundries," by E. E. Griest, Chicago Railway Equipment Co., Chicago.

"When and Where the Foundry should Use Electric Heat," by E. F. Collins, General Electric Co., Schenectady, N. Y.

Report of Committee on Malleable Castings Specifications.

"The Relation of Temperature to the Form and Character of Graphite Particles in the Graphitization of White Cast Iron," by E. J. C. Fisher, Atlas Die Casting Co., Worcester, Mass.

Aluminum and Other Non-Ferrous Metals

Following the rule established at the last two conventions the non-ferrous metal department will be included and will have sessions devoted entirely to the non-ferrous field. The expression "non-ferrous" is generally construed to represent brass foundry practice, but as a matter of fact it includes aluminum. Aluminum has now become so universally popular on account of its adaptability to so many different lines where light weight is required, that the non-ferrous department has been divided and sessions will be held epecially for aluminum.

Need for Co-operation in the Aluminum-Alloy Foundry Industry

In foundry practice for light aluminum alloys, there is much need of greater exchange of ideas between foundrymen and metallurgists connected with the different plants in the industry, and there is a definite need for systematic investigations of a number of pressing foundry and metallurgical problems. While the non-ferrous end of the foundry industry has not been so well taken care of by the American Foundrymen's Association as was warranted by its importance, plans are in hand to strengthen and broaden this section in the scope of the activities of the Association.

With a view to increasing the interest and obtaining the active co-operaton of foundries making light alloy castings, a tentative plan has been suggested that the papers on aluminum-alloy founding and related subjects should be placed in one section for reading at the June convention in Rochester, and those on other non-ferrous subjects are to be read at the other non-ferrous session. With this plan in view, it is urged that those engaged in the production of aluminum-alloy castings, as well as any interested in aluminum, arrange to attend the Session when the papers on aluminum are read. It is hoped that a representative gathering will be on hand so that the needs of the industry can be discussed at the time and suggestions offered for papers on light alloys for the following convention.

The preparation of the non-ferrous sessions of the program is being arranged by L. W. Mueller of the H. Mueller Mfg. Co., Decatur, Illinois, and R. J. Anderson, Metallurgist of the Bureau of Mines Station, Pittsburgh, Pa. At the two non-ferrous sessions of the convention program the following papers will be read:

Technical Control of McCook Field Foundry—by E. H. Dix, Jr., McCook Field, Dayton, O.

The Use of Secondary Metals in the Brass Foundry—by C. T. Bragg, Michigan Smelting and Refining Co., Detroit, Mich.

Porosity of Non-Ferrous Metals—by R. R. Clarke, Pittsburgh, Pa.

Two-part castings made in three-part molds—by W. H. Parry, Brooklyn, N. Y.

Aluminum and aluminum-alloy Melting Furnaces—by R. J. Anderson, Bureau of Mines, Pittsburgh, Pa.

Melting Aluminum for Rolling into Sheet—by J. A. Lange, Western Springs, Ill.

Use of Secondary Aluminum Ingot in Foundry Practice—by W. M. Weil, National Smelting Co., Cleveland, Ohio.

An Investigation of "Segregation," with a View to Preventing its Occurrence in Castings made of High-Lead

Bronze—by Prof. R. E. Lee, Allegheny College, Meadville, Pa.

Association Arranges for Annual Exchange of Papers with European Associations

A feature of this year's convention which will be appreciated is that of having representatives of foreign countries read papers on how foundry work is done in their countries.

Through the efforts of H. Cole Estep, formerly secretary and chairman of the A. F. A. committee on papers, now located at London, arrangements have been completed with three of the most prominent European Foundrymen's Associations for an annual exchange of technical papers.

This movement had its beginning in 1920 when an agreement was reached with the Institution of British Foundrymen, providing for each association to be represented on the other's convention program.

G. K. Elliott, metallurgist of the Lunkenheimer Co., of Cincinnati had the honor of being the first A. F. A. representative to read a paper before the British Institution, presenting a paper before the 1921 convention on Gray iron in the Electric Furnace. Enrique Touceda, consulting metallurgist for the Malleable Castings Manufacturer's Associations will read a paper before the 1922 British convention.

The Association Technique de Fonderie de France and the Association Technique de Fonderie de Liege, the foundrymen's associations of France and Belgium respectively, have now joined in the exchange arrangement, an arrangement which will promote a friendly exchange of ideas between the leading foundrymen of the world.

As a result of this recent movement the following European papers will be presented at the 1922 Annual Convention of the American Foundrymen's Association which will be held at Rochester, N. Y. the week of June 5 to 9.

Belgian Method of making Typewriter frames, by J. Leonard, President, Association Technique de Fonderie de Liege.

Paper by F. J. Cook, of Rudge and Littley, Staffordshire, England, representing the Institution of British Foundrymen.

From the Association Technique de Fonderie de France, four papers.

Electric Furnaces, by R. Sylvany.

Side Blow Converters in the Foundry, by T. Levoz.

Discussion of Triplex Process of Making Malleable Castings, by T. Levoz.

Destruction and Reconstruction of French Foundries, prepared by members of the French Association.

In addition to the above exchange papers, a paper on European Molding Machine Practice, vs. American Molding Machine Practice by E. Ronceray of Ph. Bonvillian and E. Ronceray, Paris, will also be read.

Entertainment

It will be noted that no session will be held on the afternoon of Thursday, June 8th. This is for the very good reason that it would not be attended. The entertainment committee, of which Mr. H. G. Hetzler of North West Foundries, Rochester, is the chairman, is sparing no pains to have this part of the programme to be one which will be remembered. As pointed out in previous issues, Rochester and the entire surroundings revels in flowers and fruit, which will be in full bloom during the convention week. For the entertainment of the ladies, the committee has arranged for automobile drives on Tuesday through some of the most beautiful of the sightseeing districts while the men are delving into the pros and cons of steel castings and side-blow converters, but the real entertainment will be on Thursday afternoon when both ladies and gentlemen will enjoy a trip on Lake Ontario. The steamship "Cayuga" of the Canada Steamship Lines has been chartered for the occasion.

The "Cayuga" is a twin screw steel steamer, 315 feet in length and with a carrying capacity of 2,150 passengers. It plies regularly between Toronto and Niagara River ports, and is the largest and fastest passenger steamer on the Great Lakes.

The excursion will start from the mouth of the river at one o'clock and will return about ten. Special cars will start from the exhibition grounds and pass most of the hotels, picking up passengers and delivering them to the dock. The cars will also meet the boat on its return. The trip will extend across the lake to the picturesque little city of Cobourg on the Canadian side. A programme of amusements including vaudeville and dancing has been arranged. A first-class orchestra will provide music for the dancing. The American Legion band of Rochester will entertain the crowd during the entire afternoon and evening. Luncheon and supper will both be provided aboard the boat.

Water connection between Rochester and Cobourg is the only one which operates continuously throughout the year, and visitors from inland points will have an opportunity to observe how traffic is carried on between the two nations with this forty-mile barrier of water lying between. Cobourg is a thriving little place but is noted principally as a beauty spot for summer resorters. The stop in Cobourg will, however, not be of very long duration, as it is the boat ride and the amusement on board the boat that are to be the main attractions.

The Banquet

The banquet which invariably accompanies the convention will be in evidence on this occasion and will, as usual be a leading attraction. Foundrymen as a rule manage to do justice to this type of entertainment.

Keep crowding your business at high pressure and you will soon need more room for your business and more help to run it.

CANADA AND THE UNITED STATES

On Monday, April 5th, every foundryman in Canada, if he sees fit to accept the invitation, will be a welcome guest at the convention of the American Foundrymen's Association to be held at Rochester, N. Y., U. S. A., during the entire week beginning with that date. It must be remembered that the term "American" used in connection with the conventions means North American, which includes Canada. It must also be remembered that while the convention is being held in an United States city, it is not always thus. The foundrymen's convention has been held in Canada, and will be held here again. It must also be remembered that the Board of Directors also includes Canadians—not one for luck, but more than one, so that all things considered this is truly a North American Foundrymen's Convention, and Canadians who attend are to realize that they are of equal importance with our neighbors to the south. But apart from the convention, we are only sojourners in a foreign land, and we must deport ourselves as such. Don't whisper in each other's ears about the noticeable preponderance in the number of U. S. flags which will be displayed. Remember that you will be in the United States and that the star spangled banner is the flag of their country, and all others must be conspicuous by their absence to a very considerable extent. If a flag represents anything, it represents the country that owns it, and when in the United States expect to see the stars and stripes and you will not be disappointed. The decorations in the convention halls and banquet halls will likely be interspersed with flags of other nations, but the number of these will be at the discretion of the decorator, so we will forget about flags and get back to our subject.

In spite of all the tariff walls which either Canada or the United States can erect to block the natural trend of commerce between the two countries, these two nations continue to trade, and will continue to trade with each other, and why should they not? Our geographical positions make us most likely customers for each other, we are descended from the same ancestry, we talk the same language, we have the same habits and customs, and in fact our every walk in life is the same with very few exceptions. Now these exceptions are what we want to investigate. "In the beginning God created the heavens and the earth," and while he was creating the United States, he created Canada at the same time. In the year 1492 Christopner Columbus discovered America, but he did not discover either the United States or Canada. He did, however, open the way for others to discover both at about the same time, and right from this point begins one of the exceptions which we

(Continued on Page 33)

want to investigate. Why did the United States become a great, hustling manufacturing nation, while Canada was content to remain in the background? Was it because they had a better climate? Some people think it was, but do facts bear out this contention? The most populous states in the union are those along the northern boundry, and facing the Great Lakes, while their largest cities are in the border states, and an enormous proportion of their manufacturing is done in this northern part of the country, the climate of which is practically the same as that of Canada. Their largest city, and for that matter the world's largest, has a climate which is more unbearably cold in the winter time than anything which Canada can produce, and their snow storms and wind storms don't have to come to Canada for instructions.

No, it is not their climate which has made them, judging from present appearances, but if we look back we will see that it was the climate which gave them the start. The Southern States have a mild and attractive climate, where semi-tropical fruit is raised, and where most of the world's supply of cotton is raised. These natural advantages, aided by the free labor of the slaves which were formerly employed, got them on the map in good shape, and gave them a population which made manufacturing on their own hook look tempting. They had the ambition and they went to it, but they did not shove the manufacturing business in the south as they did in the north. The mild climate of the south did not seem to attract the manufacturers as did the more rigorous climate of the north. However, they made good, and we, on this side of the line seem to fear them, but if we ask ourselves the question "why" we are lost for an answer. It does not seem like a very proud boast to have to say that we can not compete with them, but it seems as though many of us are inclined that way, but Canada is awaking, and during the last ten years has made more progress than in any decade in its history, and it is a safe prediction that the next ten years will show a still greater forward stride. But the United States will still continue to supply many of Canada's wants for years yet to come. It is partly for this reason that we attend the convention—to see what they have that we want. We also have other reasons—to show them what we are, and what we represent. Canada is the nation of the 20th century, and all eyes are on Canada, so let us show ourselves worthy of every opportunity. Canada must and will forge ahead from now on.

The St. Maurice Paper Co., Cap. de la. Madeline, Que., is planning an extension to their mill which will cost about $2,000,000. M. Baribeau of the same place is contemplating the erection of an aluminum factory which will cost around $10,000.

The Iron Situation Must Be Faced Courageously

Failing Government Subsidy, Might be Good Business on Government's Part to Equip Scientific Bureau Placed at Service of Trade

JOHN D. McCALUM

Yesterday was the iron age, to-day is the iron age and to-morrow will continue to be the iron age, until such time as we find a suitable substitute for iron. With this thought firmly planted in our minds, let us go forward with our iron projects, in the sure conviction that, by scientific and business-like methods we may emerge from the agricultural state to the industrial state, as was the transition in Great Britain, United States, and Germany, the leading iron producers of the world. Power, prestige, and wealth (if history speaks truly) are sure to follow in the wake of the iron industry, by the nations carrying it on extensively.

If we cannot translate Canada's vast resources in iron and coal by bold initiative and co-operative effort, into dollars and cents, these vast resources are of no use to us, to reduce the 2½ billion national debt, hanging over our heads.

Figures issued by the Canadian Bureau of Statistics, for the year 1921, shew that we exported iron products to the value of $84,504,821, but against this we imported iron products worth $255,445,012. It is quite clear our new army of Trade Commissioners were not asked to find for us a market for the surplus—which, of course, was nil. Instead of which, it is also quite clear, we did not manufacture enough for home consumption by $170,940,191 worth, which looks like business suicide, by a nation whose resources have been proved vastly greater than those figures show.

Pig-iron production over the same period was correspondingly somnambulent only 695,000 short tons were manufactured against 1,090,318 short tons for 1920.

In point of fact, the official figures for the iron trade during 1921, allowing for the bad trade year, make a sorrowful story, and would seem to indicate that we have failed to do in peace-time, what we so ably did in war-time.

The situation must be faced courageously and without pessimism but strictly according to facts. Various theories have been advanced, as regarding the iron movement on a large scale. If the initial remedy lies in the encouragement of timid capital, by a system of temporary government bonusing, it might go far to give the iron trade a fair start. This has, for some considerable time, been advocated on the floor of the House of Commons, at Ottawa; but instead of giving the whole bonus, as has been advocated, to the mine-owner, it is perfectly feasible that, by splitting the bonus between the mine-owner and the blast-furnace owner, the manufacturing end would get an impetus, that otherwise would not happen. It is the manufacturing end we are most concerned with, as being the real revenue producer in the trade.

It is no more unreasonable to ask Government aid for the iron trade, than it is to ask it for agriculture.

Failing a government subsidy of an attractive nature, it might be good business, on the Government's part, to equip a scientific bureau, placed at the service of the trade, to deal with the many problems, at present confronting Canadian metallurgists. The want of such a bureau, may have a direct bearing on the reluctance of capitalists, to enter into an enterprise, which from want of exact data would seem to hold too much of an element of failure.

In the absence of coal-fields, conveniently situated to our iron ore belts, it is to our advantage to use, in our instance, all the electric power possible. Whether electricity can be adapted to iron-smelting, has not yet been conclusively proved. The electric smelter has been under discussion for some time, but experiments have been carried out on such a small scale, and at widely separate points, that at present we have no reliable data to lead us to believe that the electric smelter can reduce iron ores of known analysis, to produce pig-iron, of the expected grade and quality. All we do know at present, of the adaptability of electricity to the iron smelter is, that it can take the place of coal and coke as a reducing agent. This evidence is entirely unsatisfactory to the iron-master, who would hesitate to erect and operate an electric smelter giving results in iron, of a kind different from the grade desired. A round-table talk amongst the iron authorities of the Dominion would be helpful, in discussing, in a frank manner, those questions requiring immediate attention. Some of the matters of moment are the best method of dealing with our low grade ores; the possibility of competing in the foreign market, with our neighbours in the United States; some plan whereby our workmen may be able to get the necessary scientific training, to ensure successful operation; plotting out certain districts, to be fostered and developed, as Canada's future iron centres, and generally forming plans, based on the experience and methods of those nations successfully carrying on the iron trade, so that failure may be made impossible.

When we once get a good start, and get the iron in our blood (so to speak) it will prove the best tonic possible for a financially obligated, and over-burdened Canada.

There is a very narrow line between success and failure. Which side of the line are you on?

Cast Iron Water Pipe Made by de Lavaud Process

Melted Metal Poured Into Revolving Mold is Deposited by Centrifugal Force Against the Wall of the Mold—Makes a Dense Grained Homogeneous Casting

THROUGH the courtesy of Mr. Gordon Perry, president of the National Iron Corporation, Toronto, a representative of Canadian Foundryman has been privileged to view personally the pouring of cast iron water pipes in a permanent mold without a core, and also to inspect the molds and mode of operation.

This company has a fully equipped and thoroughly up-to-date pipe foundry for the production of sand molded pipe, and in addition has three sizes of machine for the manufacture of pipe by the de Lavaud process. The sizes which are made by machine are four, six and eight inch diameter. The larger sizes are still made in sand, but will probably be changed over in due course.

The manufacture of cast iron pipe for waterworks purposes is a line of foundry work which is perhaps underestimated by the average citizen as every little country village must have its water system, and every extension in the larger centres must be accompanied by a corresponding extension of the water mains, so that the manufacture of the pipes can truthfully be classed as production work. The method which produces the greatest output with the least expense is the method which receives first consideration provided the quality is what it should be.

The usual method is to mold the pipe on end in sand, but this method will not be described in the present article. Water pipe, it will be remembered, is not plain straight pipe of even thickness, but is made with a heavy bell mouth at one end to receive the spigot of the next pipe. This bell mouth has an undercut groove in it, while the other end has a bead to correspond. This groove and bead are to act as anchorage for the lead which will be poured and caulked into the joint to prevent it from leaking.

All of this adds to the work of molding the pipes.

Water pipes when in service must be perfectly tight and sound enough to stand the high pressure to which they are subjected.

In the illustration Fig. 1, will be seen the de Lavaud machine which with the process of casting will be described. In accordance with the laws of centrifugal force, a body revolving or travelling in a circular course tends to move itself in the outside extremity of the circle. The more rapidly it is revolved the greater is the force which impels it to the outer wall of its confine. This is the principle on which the machine works. Centrifugal force has been used in making piston ring blanks and similarly simple castings but to successfully cast a long pipe with the uneven design just mentioned required an entirely different arrangement.

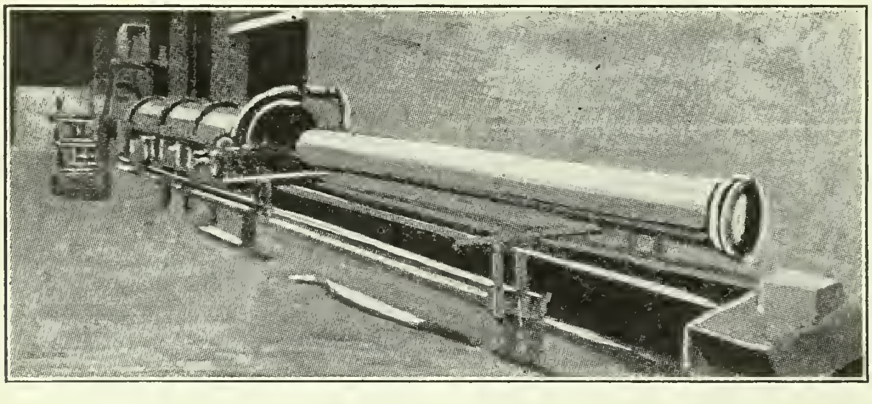


Fig. 1.—14 inch De Lavaud Pipe immediately after leaving machine.

It was in 1914 that M. de Lavaud, a native of France and a graduate of L'Ecole Nationale des Points et Chaussées, but at that time a resident of Sao Paulo, in Brazil, conceived the idea that cast iron pipe might be commercially manufactured by the centrifugal process. Since then he has devoted himself to perfecting the method, and it may now be said that the real difficulties have been overcome, but while it looks to be a simple contrivance it was not arrived at without the expenditure of enormous sums of money as well as years of effort. It is said that the experimental work has involved the expenditure of upwards of $750,000.

Nature of Process

The process utilizes the centrifugal force which rotation develops in a revolving mass, to compel molten iron to line itself in a shell of uniform thickness on the inside of a horizontal water-cooled rotating cylinder, the inside diameter of which is the same as the outside diameter of the pipe to be manufactured, or in other words the rotating cylinder is the shape on the inside, that the pipe to be made, will be on the outside, the same as it would be if made of sand. The cylindrical mold is revolved on its axis by an impulse water wheel integral with itself, and is flared at one end to give the proper contour to the bell-mouthed end. The mold revolves in a cylindrical stationary casing, shown to the left in the illustration Fig. 1, and is supported at two points in its length by two pairs of friction rollers which are carried on the inside of this casing. The shape between the mold and the casing is kept full of circulating water, which flows through this cavity at nominal pressure only. This water is to keep the mold from getting overheated from the melted iron being continually poured into it. The mold, not only requires to be the proper shape for the outside of the pipe, but it must have an internal flange at each end to regulate the thickness. If the pipe is to be half an inch thick the flange must extend inward for half an inch. If too much metal is poured in it will only make the casing the thickness which the flange holds in and the balance will flow out. From this it will be seen that whatever is the inside diameter of the flange at the small end of the pipe, it must be the same at the other end, and as a consequence the inside diameter of the pipe would be parallel right through the entire length. To overcome this a core is placed in the end to form the bell. This is the only core employed in the entire process and this, incidentally, provides the undercut channel for holding the lead, as well as the bell mouth. The machine, as will be seen in the illustration has a bed similar to a lathe. The pipe shown is one which has just been made. If the mold which is shown at the left of the machine had been at the right the pouring arrangement could be seen. It consists of a trough the length of the pipe and fastened at the end next to the cupola. This trough is lined the same as the trough of the cupola. The metal is supplied to this trough by a tilting ladle operated by hydraulic pressure. When about to pour a pipe the mold is placed as shown in the engraving, at which position the extreme end of the trough where it is shown slightly bent downwards will be at the beginning of the bell. The water power is turned on and the mold revolves at the proper speed, which is about one thousand feet per minute. As soon as the proper speed is gained the metal is poured in. As soon as the bell is filled the mold automatically moves forward, allowing the metal to be distributed uniformly. The revolving of the mold, the forward movement of the same, and the tilting of the pouring ladle are all done by water power, accurately gauged so that the iron cannot be other than evenly and properly distributed throughout the entire casting. As soon as the proper amount of iron has been poured to fill the mold the pouring stops and the mold is allowed to continue revolving for a few seconds, which is all that is required, after which a stop arrangement is dropped into position to prevent the pipe from following the mold on its return trip. The bell end of the mold will of course have to be removed to allow the pipe to slip out. The mold is now returned to its original position, preparatory to pouring another pipe. The shrinkage of the metal allows the newly made casting to slip easily from the mold onto the skids shown in the illustration. The entire operation can be quite easily accomplished in three minutes but on an all-day run the gang of seven men, which includes the cupola man will turn out 14 complete pipes per hour. When the pipe is delivered to the position in which it is shown it is practically complete, as there is no cleaning to be done excepting the one core which forms the inside of the bell.

Because of the fact that the iron solidifies in contact with a water-cooled iron mold, the surface will be to a very slight degree chilled, to perhaps a depth of 1/32 of an inch. This would in no way weaken or injure the casting but it might make trouble for the drill when tapping for house services, and it might also have a slight straining effect on the casting. To overcome any possibility of trouble all the pipes are annealed. When everything is running smoothly the pipes are put in the annealing furnace red hot, just as they come from the mold, but this is not necessary although it is a saving. The annealing furnace is of the muffle type and oil fired. The pipes are fed in by an ingenious device which rotates them as they advance, so that all portions are subjected to, as nearly as possible, the same flame intensity. The operation is controlled with the aid of pyrometers. The pipes are taken from the furnace after six or seven minutes' exposure to the flame and are allowed to cool in still air. The result is that while it is almost impossible to touch the outer surface with an ordinary file before heat treating, there is little if any difference in the hardness, inside and out, after the annealing process has been completed. This process must not be confused with that of annealing malleable iron which takes several days to accomplish. Malleable iron castings are made from white hard pig iron while the pipes are made from first-class soft pig iron.

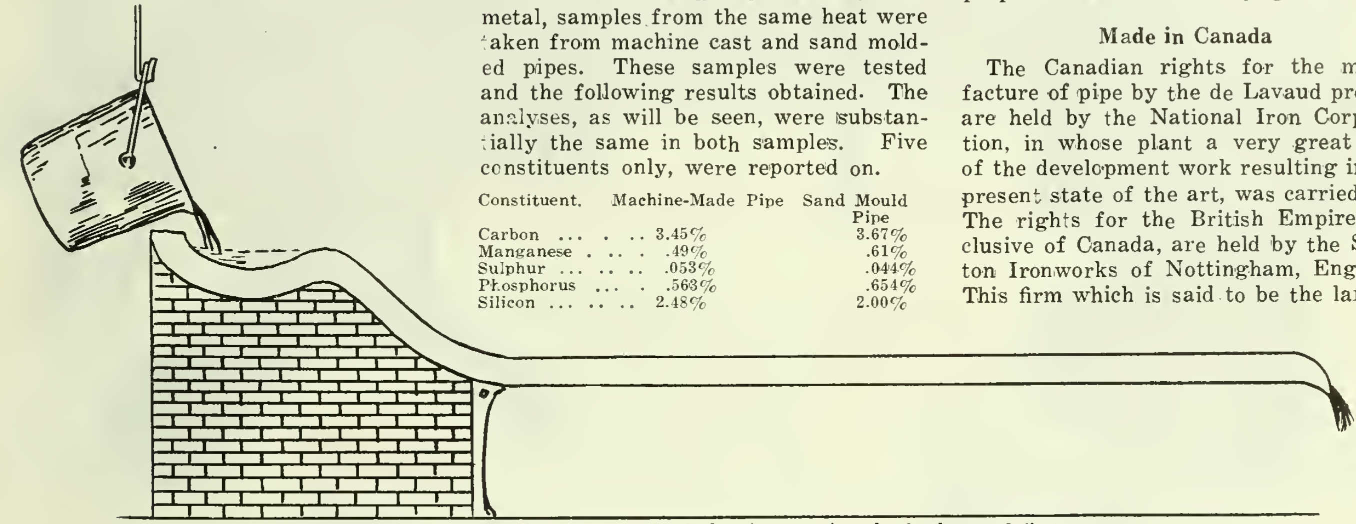


Fig. 2—Trough which extends entire length of the pipe, pouring the furthest end first.

In order to learn the effects on the metal, samples from the same heat were taken from machine cast and sand molded pipes. These samples were tested and the following results obtained. The analyses, as will be seen, were substantially the same in both samples. Five constituents only, were reported on.

Constituent.	Machine-Made Pipe	Sand Mould Pipe
Carbon	3.45%	3.67%
Manganese	.49%	.61%
Sulphur	.053%	.044%
Phosphorus	.563%	.654%
Silicon	2.48%	2.00%

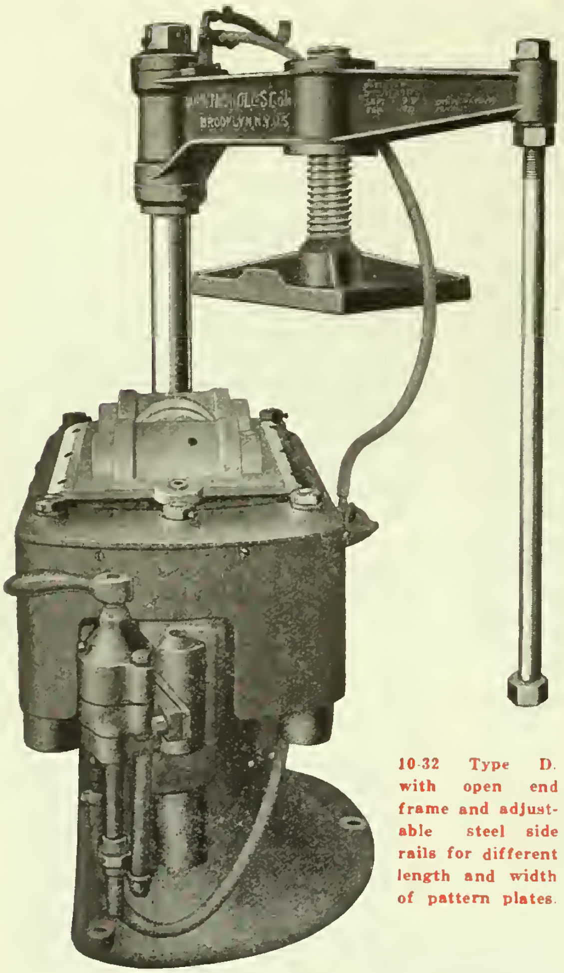
The machine-made casting exhibits a close-grained dark gray fracture free from blow holes, as will be shown by test . The metal machines freely, and if there is any difference in hardness between the outer and inner surfaces, it can only be recognized by the aid of the Brinell hardness testing machine. Roughly, the tensile strength of specimens cut from the machine-made pipe was 2.3 times as great as that found for specimens cut from sand mould pipes. Similarly, the ratio of strengths in cross-bending and the capacity to resist shock were 1.9 to 1 and 2.0 to 1 respectively in favor of the machine-made product. The so-called resistance to shock, it will be remembered, is really the measure of the capacity of the material to absorb work for energy, and is often expressed in inch-pounds per cubic inch. The modulus of elasticity (Young's modulus), is a measure of the rigidity or stiffness of the material and was found for both classes of material. Briefly, the value of this coefficient was 2/3 greater for machine-made pipe than for specimens cut from pipes made in the ordinary way. That a 6-in. pipe with walls 0.28 in. thick can sustain an internal hydrostatic pressure of 1,250 lb. per sq. in. without failure proves its fitness for service. This pressure produced, by computation, a circumferential tensile stress in the metal of the pipe equal to 13,900 lb. per sq. in. Recent researches in the field of electro-chemistry have established pretty well the principle that a metal which is homogeneous in its structure and properties is not likely to develop those differences of electric potential that make for corrosion in service. The very homogeneous structure characteristic of de Lavaud metal would indicate that pipe made therefrom will possess high capacity to resist corrosion, especially in underground service. The results of the laboratory enquiry on the whole are very favorable to the machine process and the quality of the metal produced thereby. Because of the general smoothness of the interior of the bore, the hydraulic properties should be very good indeed.

Made in Canada

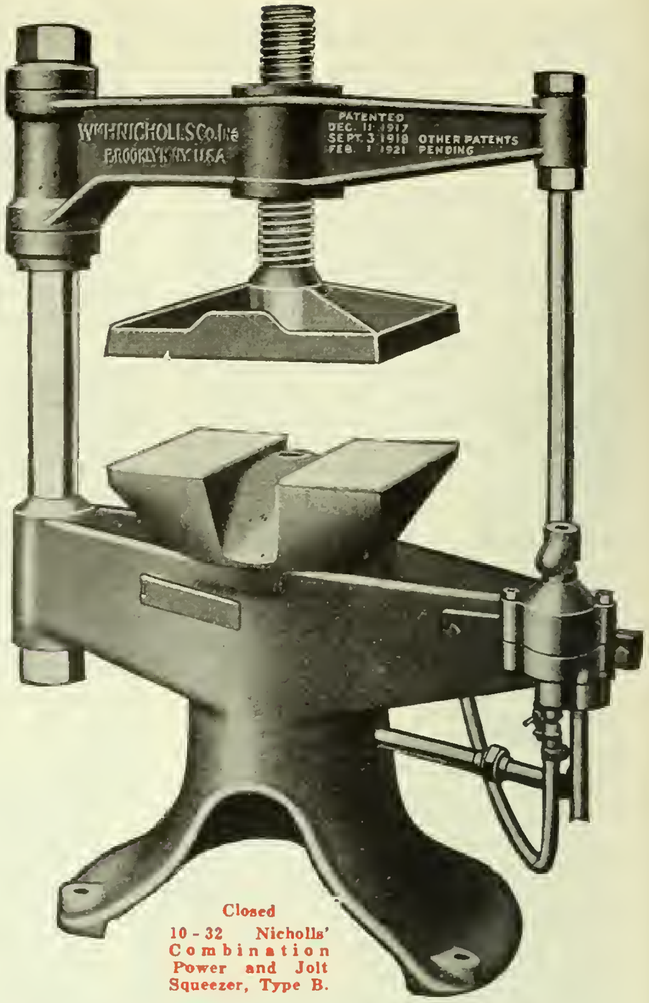
The Canadian rights for the manufacture of pipe by the de Lavaud process are held by the National Iron Corporation, in whose plant a very great deal of the development work resulting in the present state of the art, was carried out. The rights for the British Empire, exclusive of Canada, are held by the Stanton Ironworks of Nottingham, England. This firm which is said to be the largest manufacturer of cast iron pipe in the world, is putting on the market immediately, 4-in., 6-in., 8-in., and 12-in. pipe, and expects to be operating ten machines by the end of the present year. The Stanton Ironworks in addition to supplying a considerable portion of the needs of the United Kingdom, ships annually a very large tonnage to India and other British dependencies. The erection of local plants to supply some of these distant markets is a very possible and indeed a probable future development. The manufacturing rights for Japan, China and Siberia have been acquired by a Japanese company, Tsuda and Co., of Osaka, Japan. This would seem to be a market of very respectable immediate proportions and of wonderful possibilities.

The history of invention has shown that many of those discoveries which have exerted epochal influence in industry have been the result of accident rather than of patient, purposeful work directed towards a specific objective; and that usually the person with the original inspiration is not the one to develop the process or appliance for commercial use. The de Lavaud process of making pipe seems to have been an exception to this rule. A trained technician, believing that perfection had not yet been attain-

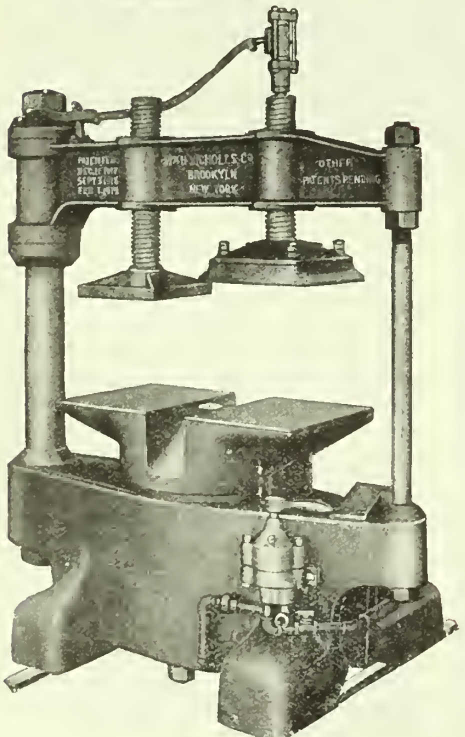
(Continued on page 33)



10-32 Type D. with open end frame and adjustable steel side rails for different length and width of pattern plates.



Closed
10 - 32 Nicholls' Combination Power and Jolt Squeezer, Type B.



14-42 Combination Duplex Portable Jolt, Squeeze and pattern drawing device. This combination can be made up with three different types of heads or drawing devices.

DESCRIPTION OF THE 14-42 DUPLEX PORTABLE MACHINE

THIS machine is built for making principally a cope and drag on the one machine. There are two quick adjustable screw heads so that you can readily adjust them in height for different depths of copes and drags. In many cases the cope can be made on a split pattern plate attached on the jolt head and the drag can be made on the right hand side and rolled over before squeezing and the pattern drawn with the electro magnetic drawing device, both halves being squeezed at the same time. The squeeze is made on the up stroke of the piston and the draw on the magnetic side will be made while the mold is withdrawing on the return downward stroke of the piston by gravity. The valve is placed low and has a horizontal handle and can be started jolting very conveniently by the operator with the side of his knee.

The position of this valve also permits without interference, for the operator, to roll over the drag either from the front or right side, as when the head is thrown out the end will be open.

This machine has sufficient large piston areas, has a 6″ jolt and a 14″ squeeze and all parts are made up to our regular standard, made of semi-steel castings. All castings are rough machined and finished in grinders, also the pins, bushings, contact and drawing parts are of steel hardened and ground and it is covered by our regular guarantee to keep them up for ten per cent. a year of their cost.

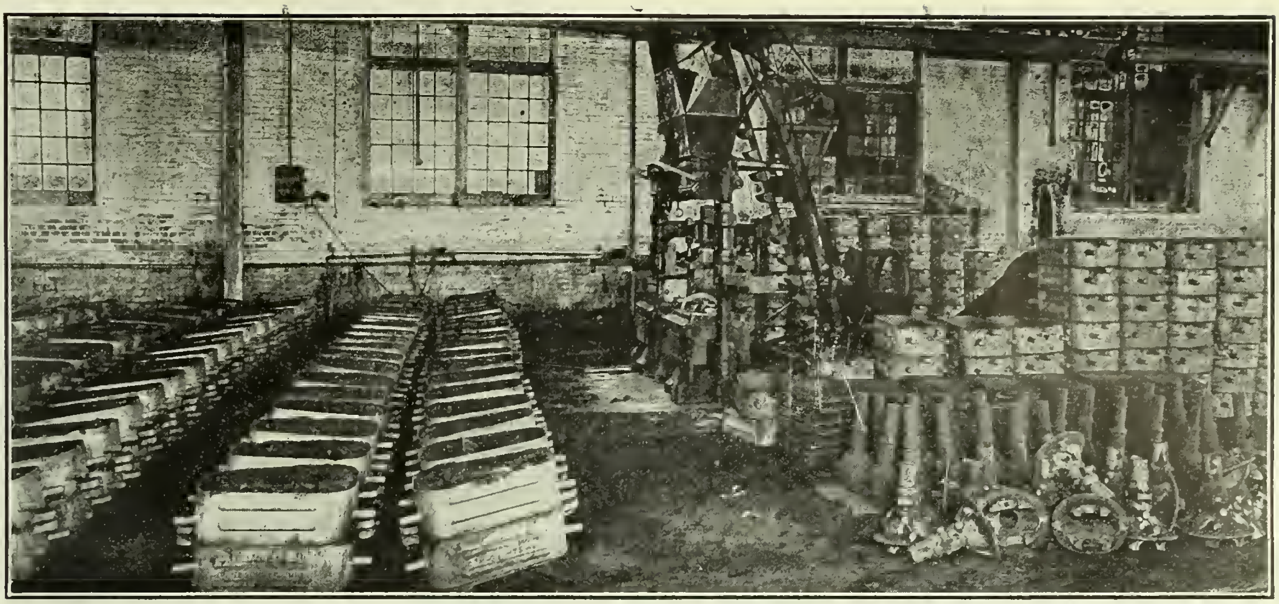
Every operation of the machine is accurately and mechanically done.

This machine is intended for a long narrow floor so to minimize the distance in which the sand, empty flask and molds have to be carried.

WM. H. NICHOLLS CO., Inc.

8-10 College Place, Brooklyn, N. Y. 10108 Detroit Ave., Cleveland

Manufacturers for France, Italy, Belgium, Spain and Switzerland, Glaenzer & Perreaud, 18 Faubourg du Temple, Paris, France



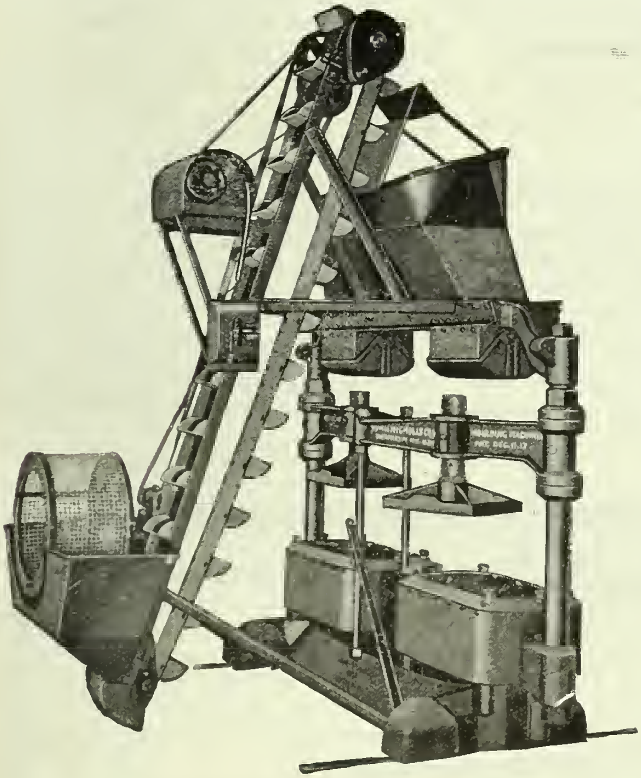
Floor scene with 12-36 Type D Duplex Portable.

DESCRIPTION OF 12-36 TYPE D DUPLEX PORTABLE

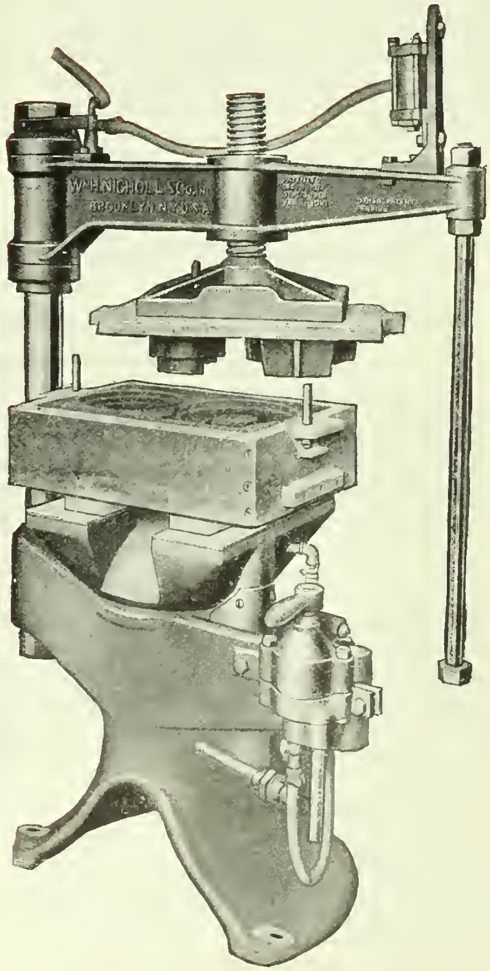
THIS Machine comprises two of our 12-36 Type D. stripping plate molding machines made up special and mounted on a base that is portable. In connection with this, we use a riddle, sand conveyor, a double boot hopper with sand gates.

The machines are set down lower than our standard machines but are about ten feet high to the top of the hopper. It is self contained and runs on four wheels and on one job that we have worked out we have increased the production over 200% and is built especially for large production jobs for foundries where they do not have sand or mold conveyors.

This machine is intended for a long narrow floor about twenty feet wide by eighty feet long and the molds are shaken out and the sand piled in a row the length of the floor and through the middle. One man shovels the sand into the riddle which cleans and thoroughly mixes it, this man also has time to put on one flask and asset the operations, the sand is then conveyed into the hopper, dropped into the flask and made into molds and set on the floor directly in front of the machine as it travels along on rails which are bedded in a good solid concrete floor. When the molds are shaken out the flasks are also placed in two long rows, on each side of the sand heaps, copes on one side, drags on the other and as the machine moves along the location of the sand heap, the flask and the floor space for putting down the molds, requires the smallest amount of handling and the minimum distance to travel.



12-36 Type D. Duplex Portable.



10-32 Type E Jolt Squeeze and Electric drawing device.

WM. H. NICHOLLS CO., Inc.

8-10 College Place, Brooklyn, N. Y. 10108 Detroit Ave., Cleveland

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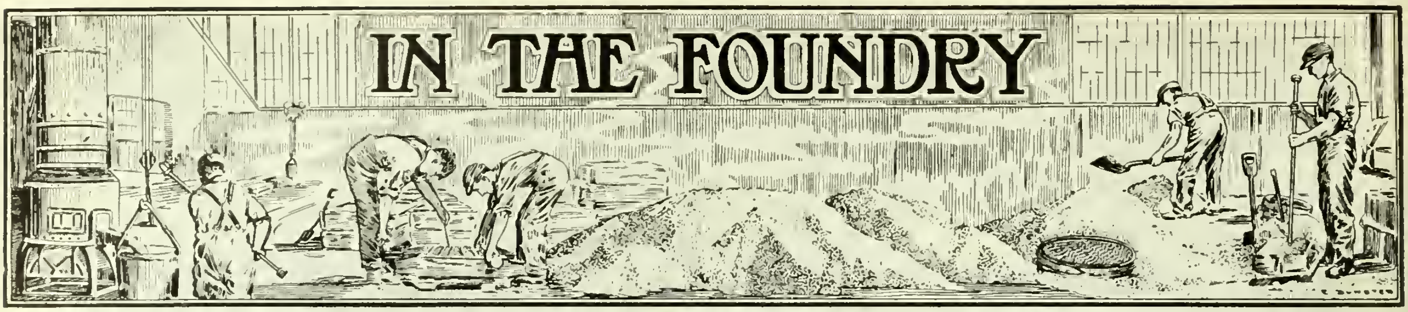


Heavy Casting has Shrink Hole Under Main Riser

Different Methods of Molding Heavy Shaft to Prevent Shrink Hole Under Riser—Heavy End Slightly Elevated is Recommended—One Riser Only is Also Advised

THE following question has been received by our letter-box department, but being rather a large proposition I have decided to put it by itself and endeavor to answer it from my own experience as well as from the ordinary run of foundry practice.—Editor.

Editor Canadian Foundryman:—We are enclosing a sketch of a cast iron shaft we have been making, and while some of them are apparently solid and sound, others have shown a large shrink hole under center riser, of which there were three.

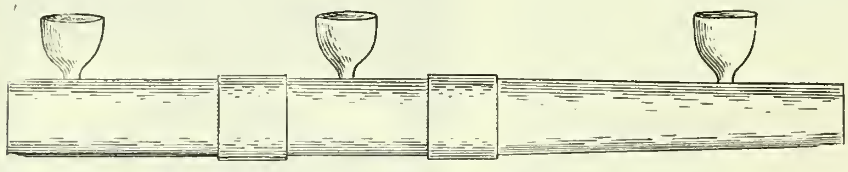


Fig. 1.—Casting which showed shrink under center feeding head.

We realize the proper way to make this would be to cast it on end, but as we have been making this on the side for years with fairly good success, and our equipment is to make it in this way, we do not want to go to the expense of making new equipment if it can be avoided.

We have been ramming them on their side in dry sand and running them through whirl runner on one end, the end risers being fed part of the time, and the center one as long as we could get it to take iron. We have decided to cast it on incline running it on low end and putting large feeder on piece at top end to be cut off.

What is your opinion of this job?

The mixture runs about as follows:—silicon 1.50 to 1.70, manganese .45 to .50, phosphorous .500 to .575, sulphur .105 to .115, using 200 pounds of boiler plate cuttings per ton.

Kindly let us have any suggestion you can regarding this and oblige.

Answer:—Your metal mixture is all right and your equipment is also all right if you have been getting good castings some time, so the fault is undoubtedly in the management.

A shaft or roll of such dimensions would certainly be better if poured on end, but you would have the same trouble to contend with in guarding against shrink hole under the riser as well as dirt in the top end.

Castings of this kind are usually made with a lot of surplus length when cast on end, and this extra length is cut off in the machine shop, thereby removing all dirty, and shrunken metal.

No matter how the mold is made the riser must be kept in a fluid state until after the casting is set or else it will do more harm than good. A casting never draws out of shape until some portion of it is turning from a fluid to a solid state, after which the portion which sets first continues to shrink and draw away from the portion which is still fluid. The metal immediately under the riser is always the hottest metal in the casting, unless it is possible to keep the riser itself fluid with fresh iron from the furnace. The metal surrounding this spot, as it cools and shrinks draws from the hot metal which is entering through the riser. If by any means the riser becomes choked before the last bit of metal under it is set, there is nothing for this bit to draw from as it cools and shrinks so it either pulls itself apart in all directions or else settles from the top, which latter it is most likely to do in a heavy piece, showing after the riser is broken off. Your method should give good results if properly handled. It would be better to have the neck of your riser larger, even though it leaves a larger chunk to turn off. If you only lose one casting in a hundred it will cost you more than the turning down of these lumps.

Other Ways of Molding

There are other ways of molding this class of work. In Fig. 2 will be seen a method which has many advocates. Place a riser at each end, beyond the pattern and have a channel cut from this riser into the mold. This channel may be very heavy, if fileted where it joins the casting, as it will break from the flat end more easily than from the curved top of the casting. The gate will be at the side as shown. A single gate would do but two works well. These should be about an inch wide and reach from the parting to the bottom of the casting. They may be joined together

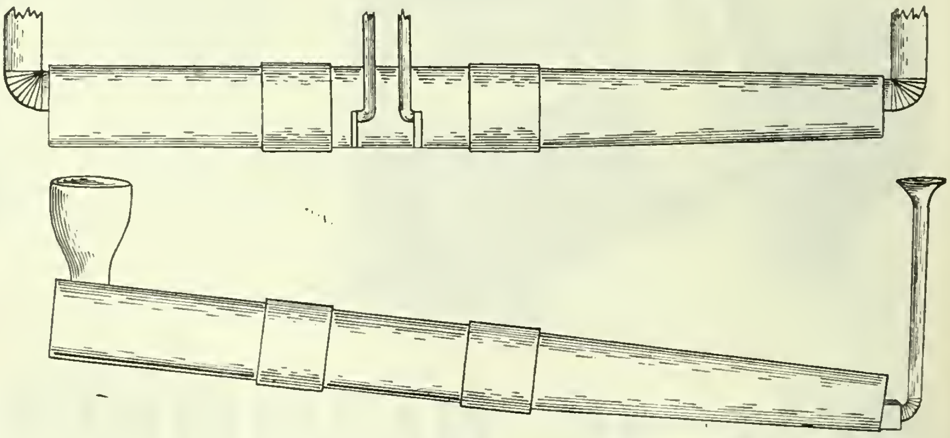


Fig. 2.—Same casting gated on the side and with riser on each end. Fig. 3.—Casting poured on incline. Riser could be at end similar to Fig. 2.

and have one large sprue or there may be a sprue for each one, set a little to one side of the gate to break the force of the metal when dropping down, the two being connected by the pouring basin on top of the mold.

Still Another Way

A third way, and the one which I personally prefer is to do similar to what you suggest, but perhaps not exactly the same. Most molders in raising one end of a mold will raise the end containing the lighter portion of the casting, for what reason they are not able to explain. To make a sound casting it is desirable to have the metal set first at the bottom and have the fluid metal above it automatically supply the shrinkage deficiency. This can be best accomplished by having the lightest part at the lower end. This lighter part will naturally cool first, no matter where located. By having it at the lower end, the extreme top will be the last to congeal, and this can be fed from a heavy riser. No matter how the mold is made the riser must be heavy enough to remain open until the cast is set, and high enough to give pressure sufficient to force the fluid metal into that which is congealing.

A point worthy of consideration is that of the number of risers employed. This has been a subject of much contention and argument ever since molding has been practised and it does not seem to be settled yet, but I am staunch for the argument that one riser is all that is required. I claim that the riser on the small end of Fig. 2 could be eliminated and cause no bad effect, although being poured on the level and gated at the middle gives it the appearance of usefulness. The fact that your two end risers, when broken off showed sound metal, although the feeding had been abandoned just when it would be expected to be most useful is evidence that they were of no use there in the first place, and that your center riser had to do the work which the end ones were intended to do. If the center riser had been of sufficient diameter at its smallest part to remain open until the casting was set you would have had a sound casting.

Another point which should be borne in mind in pouring heavy castings is that as soon as the iron starts to come up the riser, pouring should be stopped. If there are a few inches in the riser it can be left for several minutes or until the iron in the casting begins to get sluggish, after which the riser should be filled with white hot iron from the cupola and feeding the casting begin. If this policy is pursued and the method shown in Fig. 3 adopted I will guarantee one hundred sound castings out of every hundred molds.

When you make a mistake chalk it down on the inside of your cranium and thereby avoid repeating the same bit of foolishness.

Timely Comments on Casting Problems

In Like Manner to the Previous Article, if the Casting Sets From the Bottom Upward it Will Be Sound

During the last few months we have been publishing articles on the manufacture of propellers, principally in England and among the articles was a paper read at a convention of marine engineers by a Mr. Lambert, in which he described the foundryman's part. It will not be necessary to enumerate the different points brought out, as our readers are already familiar with them. The discussions which always follow the reading of a paper are, however, interesting and some of those which followed this paper will be in order. Some of those who took part were foundrymen and some were marine men and their stories bring out some interesting facts.

Mr. A. T. Quelch, B. Sc., O. B. E. was the first to respond with the following:

Having been employed in the making of propellers, and propeller blades for the past thirteen years, and being naturally very interested in the subject, I thank Mr. Lambert for the very instructive paper he has brought before us. There are one or two points, however, with which I do not altogether agree: these may be placed in the following order:—

Mr. Lambert says "Lightening chambers in a boss are, if possible, to be avoided because they prevent the adequate feeding of the metal to the blades." My experience, however, has been, if this "Lightening" is carried out judiciously, instead of preventing the feeding of the metal to the blades it rather tended to help the feeding of the blades. If the coring of the boss is carried well down to the after end, that is to say, the lower end of the boss in the casting position, it would ensure the metal at the lower end of the boss setting up first and the hot feeding metal put into the head would get to the thickest part of the blade, which is half way down the boss and you would get a sound job. Where there is a heavy uncored boss it is difficult to prevent the feeding operations simply pumping the metal up and down in the boss. In regard to the preparation of the molds for large solid propellers I would not advocate the moulding of these on loose moulding plates, but I prefer my own method of moulding them in pits. The weight of the large moulding plate, together with the weight of the brickwork, etc., forming the lower half of the mould, is very considerable and if you start lifting this about there would be considerable fear that some distortion of the mould might occur, especially when exposed to alterations of temperature in drying. Then there would be a difficulty in resting your plate correctly again in position in the foundry. It seems to me preferable in the case of these very large propellers to mould in pits and leave the bottom half of the mould exactly as built there, on a solid foundation, and do all the drying of the lower half of the mould, and the preliminary drying of the top half also inside the pits, by coke fires and covering over with corrugated sheets; on parting the mould the top parts of the mould are removed and finally dried in the drying stoves. I have had considerable experience of heavy solid propellers, having made four working and four spare propellers for H. M. S. "Hood," which were, I believe, the heaviest solid propellers yet made, the finished and balanced weight of these being just under twenty tons. I also made the solid propellers for the "Mauretania" and "Lusitania" finished weight about 18½ tons, and those for the "Aquitania," "Imperator" and "Vaterland," all about 16 tons finished weight, so that involves some little experience in this line of work.

Mr. R. Northover, who spoke next said:—Although Mr. Lambert has given us a very good idea this evening of the manufacture of marine propellers, nevertheless, from a metallurgical point of view, the progress we have made in recent years can hardly be looked upon as highly satisfactory. If we go back through the history of manganese bronze we find that it is nearly half a century ago that Parsons first thought of the idea of adding iron and various other metals to copper and zinc, and in thereby producing a metal which gave physical tests quite double that of ordinary brass. Since that time we metallurgists have really done very little. We have correlated, amplified, altered and explained by means of the microscope and chemical balance other people's facts, but we have really not achieved anything at all. This may sound peculiar, but at the same time it seems to me quite true.

We have today no answer in the nonferrous world to the steel man who asks for an 80 ton bronze. Before we are to make the next large step of progress metallurgists must have their attention directed to something far superior than what is so well misnamed "manganese-bronze." This something is bound to come, we do not know how, as we are at present only in the position that we must admit that we have just about learned what we still have to learn. As to the estimation of mechanical tests beforehand by the appearance of the alloy under the microscope one has no hesitation in saying that providing the chemical composition is known exactly one can give a very fair prediction of what the tests would be, unless one knows the chemical composition it is quite impossible to give even a fair idea, as, for instance, the appearance of a pure beta "manganese-bronze" and a pure beta brass are very similar and would have tests varying by many tons in tensile strength.

Concerning the thermal treatment of large castings, such as propellers, this is an important point, as castings of such large bulk take a considerable time to cool, whereas small castings do not do so, which fact presents a very definite problem and one requiring much attention and skill. There seems to be a large future for the metallurgist in bringing his skill to help that of the foundryman in the operation known as "thermal treatment," and it would seem very possible that by producing in the bronze certain special microscopical constituents also denoted by Greek letters and other than alpha and beta, that the metallurgist of the future would be able to assist the foundryman in this operation of thermal treatment. I cannot go into this particular matter more fully owing to the nature of the paper and the shortage of time, but it seems that there is certainly much to be done in the directions I suggest.

Mr. W. McLaren had the following to say: This is not a paper that the ordinary marine engineer can discuss. I have been very pleased to hear it read, and Mr. Lambert is to be congratulated on taking such patience, and going through every item. I did not think there was so much in the moulding of a propeller, but when we hear of the casting of 20-ton propellers there is no doubt there is a great deal in it. We had a propeller question here a few months ago and it was surprising to me, in regard to the boss, that some method has not been found to get rid of this enormous amount of metal. I remember once going through the Suez Canal when we stripped the propeller and had only about 18 inches left. We could go about half-speed, with the engines going at normal full speed, and I just thought, from then to now, that if we had had a smaller boss on that propeller we should have been able to do something like our original speed. That is one of the secrets that is seemingly wanting in propeller design. Cut the large boss down and get more of the most effective part of the screw, which is at the root of the blade, where it seems to me there is more solid water and less air. If, say, a dozen ships were to be fitted for a certain service it would be a good plan to find out the propeller that will give an equal and the highest efficiency in working instead of the crude method generally adopted. I do not know what the standard ships have produced, whether they have all the same speed and all a standard propeller. No doubt if you can afford it the bronze propeller is the one.

Mr. A. F. Gibbs said: As a practical moulder I say that in regard to lightening out of the hub of the propeller I do not agree with Mr. Lambert that it is not advisable to core this out. It might be advantageous if one could guarantee that solidification would take place in every part of the hub or boss at the same time, and thus there would be no separation out of any eutectic, which otherwise there would be. Then again with lightening cores you would have undoubtedly planes of weakness when the forces or laws of crystallization began to operate. I remember one practical example of the evil results of using cores. It was when we first had to make superheater header castings for locomotive cylinders, admitted that these were made in cast iron and not in non-ferrous metal or alloys, as used in the manufacture of propellers. There are, as most of you understand, a lot of cores in this type of casting. Well, we first of all tried casting with the largest bulk of metal at the bottom, which bottom side, by the way, had to be machined, and thus we thought this would give us a cleaner casting. On being machined these castings were not dirty but were porous in places. These faulty spots we traced down to the cores; sometimes they were not visible to the naked eye, but on being steam tested the steam absolutely walked through, and in every case practically about the same point. I might say all sharp angles were carefully taken off the cores and radii substituted. But we proved to our satisfaction that the laws of crystallization were operating detrimentally, and also by the aid of micro-photographs taken of the faulty parts we proved that liquation had taken place, iron phosphide Fe_3P being there in abundance. In fact two micro photos gave us very good examples of the phosphide eutectic. We subsequently tried casting these the reverse way up, giving ourselves at the same time more metal to plane off and since then we have not had any trouble whatsoever. And then again if the lightening cores occupied very much room I fail to see how the feeding of the casting could be as efficiently carried out as without any cores at all.

Referring to metal being improved by re-melting, I think it is fairly common knowledge now that taking cast iron it only improves up to a certain number of re melts; after that it deteriorates. In regard to non-ferrous metals. from my own experience during the war in the making of fuse sticks for fuse bodies. I would like to say we had great difficulty in obtaining the tensile and elongation results required by the Government. We had some new metal in, and the first batch of castings made with it gave very satisfactory results. I am afraid that then I promised to go one better thinking that on the second re-melt my metal would be improved; but to my surprise I found that these sticks were not one whit better than the first; in fact if anything they were slightly inferior. I might say that the mixture was a 60-40 brass, and as near as possible I kept to the same melting and casting temperature by the use of a pyrometer.

Mr. D. Hulme: I had an opportunity, when Zeppelins were brought down by the run, of securing portions of metal used in their construction, and used it to cast some dog collars. When these were machined and dropped they rang with a distinctive tone, different from the usual aluminum; this seemed to indicate a special mixing of metal or of treatment, which may be worth considering.

Mr. F. O. Beckett: We have heard of freezing and also of seasonal cracking of metals and the possible causes. These are interesting to know about and consider. As there are two distinct metals described, I should like to ask how this trouble arises, owing to bronze castings cracking five or ten years after the manufacture. We have had trouble of that nature in other castings and there may have been trouble with propellers. There is a possibility that there may be in some castings a difference in the metric components of the final mixture,—tin or zinc for instance. There is also a possibility of error in the pyrometer readings, in reference to bronze and brass castings, and this has always been a conundrum. Of bronze propellers I have had very little experience; one I had was when a steel wire hawser fouled the propeller and took a small lump out, but with a hammer and chisel it was smoothed over and we had no later effects. With cast iron that would have gone. On one occasion, when going through the Suez Canal, we struck a submerged pile; one blade broke, the next one cleared, but the following one was caught on the rebound and was broken. So the ship came in with two blades and did better work with the two than with four, both in regard to revolutions and speed of the ship. I think a lot might be said about the displacement of the boss. It is far too great. Contraction troubles are also ever present for consideration in dealing with intricate castings.

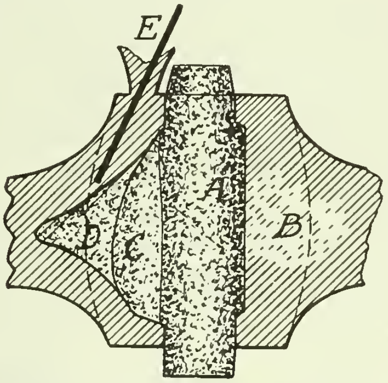
Mr. Lambert: With respect to "lightening chambers," I am confident that my colleagues in the foundry will support me when I say that cast-in lightening chambers are not considered desirable. Personally I do not like them. Apart from the fact that the presence of these chambers interferes with the regular flow of the metal, it has been found from experience that there is also a serious risk and uncertainty of the thick root section of the blades being adequately fed with molten metal during the period of transition from the molten to the solid condiion; contraction cavities may therefore result. I do not say that it is impossible to successfully cast a large solid propeller having cast-in lightening chambers, but, upon receipt of an enquiry for such a casting, it is not an uncommon thing for my firm to make representations to the customer to gain his permission for the propeller to be cast without chambers.

In such a case the chambers would be subsequently formed by machining.

With reference to the strength and practicability of the use of bed plates upon which moulds for very heavy propellers are built, it is to be understood that this paper was written to follow upon a visit to Messrs. Stone's Works paid by a party of members of this Institute, and in the paper an endeavor has been made to briefly describe the procedure adopted in casting solid propellers of average weight. Even if it were desirable to give the whole of the details describing the manufacture of each and every class and weight of marine propeller from the smallest propellers of only a few inches diameter up to the largest propellers for war vessels it could not be accomplished in the short space usually allowed for a paper in the Institute Journal.

I venture to think that, after having read a description of the methods employed, and having seen the illustrations shown upon the screen this evening, very few among my audience will fail to credit to the foundry staff of Messrs. J. Stone and Co. an intimate knowledge gained by long experience, of the art of founding large propellers in manganese bronze. Should circumstances arise—such as the casting of a propeller of abnormal weight—which calls for special consideration, I have sufficient confidence in my colleagues to feel sure that their experience and resourcefulness is such as to meet all contingencies. If it was considered that our largest bed plate was insufficiently strong to carry the requisite weight without a liability of distortion of the mould when lifting the latter, we should adopt such other means as have been mentioned. As a matter of fact one of the pictures thrown on the screen this evening showed the bottom portion of a mould for a large propeller being placed in the casting pit preparatory to building up "in situ" the remainder of the mould.

Editor's Note. There are a lot of good arguments brought out which should be of benefit to others than those employed on propellers, but the one which I want to emphasize is that of lightening the hub. It is the same old story of each having evidence to back up his argument. Personally I am in favor of reducing the weight of the hub on the lower side, while leaving it heavy on the upper side. Like the others, I have backing for my arguments. The illustration will show how I have always been successful in overcoming a lot of trouble. It must be remembered that the propeller has to receive the entire power of the engine and utilize it in propelling the ship. From this it will be realized that it requires all the strength possible. It is not apt to be damaged by working in clear water but it is apt to strike obstacles and be broken. If however it is not rigid it will spring under ordinary service, and for this reason the blades at the hub are almost the entire height of the hub and nearly a quarter of the circumference. If the hub is cored out so that its cross section is less than that of the adjoining part of the blade, there will most likely be a spongy interior to the blade just where it should be the strongest. This is a trouble which is hard to overcome, no matter how it is made, but if a little study is given to the subject it will be somewhat simplified. If the hub is left as heavy from top to bottom as the heaviest part of the blade the feeding rod, if persistently used with plenty of good hot iron should make a fairly sound casting, but a much better casting can be made by coring out the hub as I have shown. At A will be seen the ordinary chamber, used on hubs to save boring and to make the ends fit tight to the shaft. At B is a large spongy section which will develop on the inside and which will show after the casting is broken. At C is enlarged design of core which extends entirely around the core. At D is thin piece of core which projects beyond the main core and into the heavy part of the black. This latter



A shows usual way of chambering a hub. B shows castings shrunken internally. C. D, E shows method recommended.

part simply divides the metal so that it does not draw itself apart. At E is the feeding rod. It will be observed that from the bottom of the hub right to the top the thickness increases. If left to cool by itself it would set first at the bottom and work its way to the top. By using the feeding rod a perfectly sound casting can be assured, as the bottom will have fluid metal to draw from and so will every inch of metal as the feeding rod is forced towards the top. A casting cored like this will be stronger and better in every way than if like A and B.

CAST IRON WATER PIPE

(Continued from page 27)

ed in such an ancient art as the casting of iron pipe, and appreciating the commercial possibilities of a method that would reduce labor and save material has devoted his time and wealth patiently for years to the development of his dream. The perfection of a new process for the manufacture of pipe is an achievement of the inventor, in the advantages of which he and the public alike will share.

NICKEL PLATE TO REPLACE TIN PLATE

Experiments of a far-reaching nature to Canadians are being conducted in the tin-plate works at Swansea, Wales, with the object of substituting nickel for tin in the coating of tinplates. A company has been formed to deal with the movement which is known as the Steel-Nickel Syndicate. A prominent member of the syndicate is Henry Mond, son of Sir Alfred Mond. Production of rustless plate is aimed at.

This could most likely be accomplished with the tin as easily as with nickel if sufficient tin were used, as was done years ago when tin-plate eavestroughing remained bright after 75 years of exposure to the elements. However, since tin is none too plentiful and nickel is in abundance in Canada it is to be hoped that the experiments prove successful.

SICKNESS AMONG OFFICE WORKERS

How many days per year are annually lost by each person engaged in gainful occupation in the United States has long been a question. In a recent report the United States Public Health Service throws some light on the subject, and also on the relation that the health of office workers bears to that of all workers.

The figures on which the report was based were very carefully compiled by a large western corporation during the year ending Jan. 31, 1921, during which it employed an average of 1,282 office employees. An exact record was kept of the hours of work lost by each person from sickness or injuries, the sickness being diagnosed by the medical department or by the family physician. The result showed an annual loss of 8.15 days per person.

This compares with the estimate made by the committee on industrial waste of the Federated American Engineering Societies, which reported that "the 42,000,000 men and women gainfully employed in the United States probably lose on an average more than eight days each annually from illness disabilities."

The fact that the majority of the 1,282 office employees were women whose sickness rate is usually higher than that of men, and that a loss of about two days per person was caused by influenza during the epidemic of February 1920, are two factors which tend to make the sickness rate in question higher than the average rate for all workers in a normal year. On the other hand, the fact that the average age of the office employees was only 32.7 years, that clerical and executive work is relatively free from health hazards, and that the health of the group was carefully guarded medically would tend to make the rate in question lower than the average rate for the gainfully employed. Allowing for these factors, the author of the report concludes that the eight-day estimate of the committee of the engineering societies for all workers probably is not too high.

Cores and Core-Making Practice Good and Bad

Cores Are Used Where Green Sand Would be Less Expensive and Just as Good—In Other Cases the Reverse is Practical with Unsatisfactory Results

By A. SKINNER

COREMAKING as a trade is one thing, while deciding between cores and green sand is another. The man who does the deciding will be confronted with the proposition whether a pattern should be molded one way and leave its own core or molded in some other position and have a dry core set in.

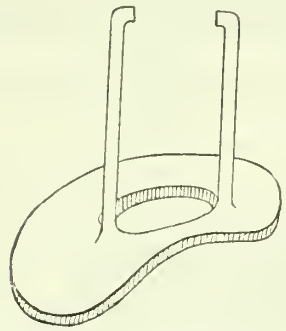


Fig. 1.—Sample casting which could be moulded just as it stands, and leave its own core.

This is not always easy to decide until after the work is done and tried out when it will be seen that the wrong method had been decided upon.

There are other cases where a little bit of ordinary good judgment would enable a proper decision to be arrived at in the first place.

I visited a patternmaker's shop a short time ago and found him working on a pattern and core boxes for a job similar to Fig. 1. This, it will be seen is just a simple little ferrule or sleeve with a concaved flange on one end a little bit off centre. The inside is a plain round hole with a slight thickness projecting inward on one end as though to hold babbitt. Four of these were to be made in aluminum and fastened to a gate or possibly on a match plate.

When "the fellow who would occupy the space which should be occupied by a moulder," got his mold lifted off and the patterns drawn he would have to set eight cores in it before closing it. Not only this but he would have to slip one through the other for each piece. All of

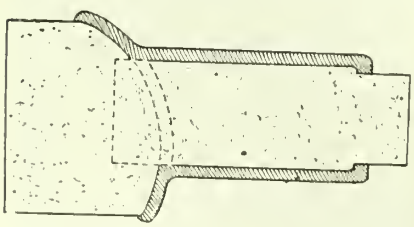


Fig. 2.—Same casting being molded on its side with two cores fitted together to form the inside.

this because of the way the patterns were made.

In Fig. 2 will be seen the single pattern with the core print in it. It will not be necessary to show the core boxes, as they were just the shape of the two cores which are required.

The chunky core to the right has a round chamber in which the round core fits to an exact depth. This leaves the combined cores exactly right to fit the print in the pattern, making it impossible to set it wrong.

The alternative way of doing this job would be to make six of them instead of four and attach them to a gate, or possibly a match plate. Fit them to a follow board if on a gate in such a way as to have them standing on end and the sleeve part in the core. Don't have any core prints or cores, but let the pattern leave its own green sand core.

As I have said, new patterns were being made and a little draft could be allowed inside and out. Now what are the good and bad features in the two methods?

With the last described where no cores were used, a molder who has had experience enough in his work to be able to lift off his core without letting one corner get ahead of the others should be able to make that job for six cents and then conveniently make six dollars per day, but unfortunately the molder who has had experience enough to life a core on the level is the kind of molder which it was not the intention to employ.

Take the other method. A man who is prepared to take less money and work just as hard will have to work harder in order to put up as many molds and set eight cores in each one. In addition to this another man will have to be stepping along at a similar pace if he makes the eight cores while one mold is being made. To this must be added the cost of the sand and binder in the cores as well as the expense of mixing and baking, and all of this for the satisfaction of employing unskilled labor.

Unskilled labor is all right in its place but it is hard to figure out how the world is going to be any better if we discourage the skilled workman entirely. Molding may not be much of a trade but it is a trade which is hard to get away from, and it is a trade which should be encouraged particularly when a skilled workman would produce the work from a proper pattern for less than half the price which has to be paid to an unskilled man with patterns made especially for him.

The case just cited is a true picture of what I saw with my own eyes and is not exaggerated in the least.

Another case equally as short sighted was that of a concern manufacturing pumps. In this case the very reverse was in evidence. A pump bucket consists of three castings and a leather. The first is the valve seat, on top of this is the leather with an iron weight riveted on top of it, and then on top of that is a casting which holds the leather in its place and also acts as a frame for the entire affair. The rod is attached to this piece. It has legs projecting upwards and coming together at the top.

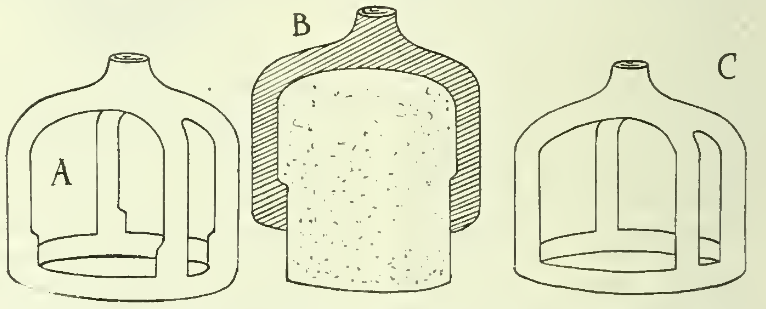


Fig. 3.—A shows casting with clearance for tap. B shows how the core was used to advantage C shows casting made without core and without clearance for tap.

In appearance it is similar to (a) Fig. 3. On the inside of this is a little bit of extra thickness of metal for a height of about half an inch. This is threaded for the bottom piece to be screwed into. Above this half inch the casting is chambered and to allow clearance for the tap and incidentally to save iron.

These people had good patterns which were working all right and making nice castings but each one had to have a core in it similar to (b) Fig. 3. To save expense of making and setting the cores they made patterns similar to (c) Fig. 3, which would leave their own cores. This of course made a heavier casting but they thought it would be a saving for all that. It also made it more

(Continued on page 37)

How Large Journal Bearing Should Be Made

Side Rings Fastened on with Loose Dowels—Slab Cores Placed Above Ring to Support Overhanging Sand—An Alternative Method

By M. E. DUGGAN

WHEN the drawings for this pattern were handed to me, two questions presented themselves for solution before starting on the work.

(1) How would you make the pattern?

(2) How is the mold made and the casting produced?

Answer:—

(1) I made the pattern with the side rings loose.

(2) At the time the pattern was made I could not answer the question, "How is the mold made?" I took a chance, just passed the buck to the molder.

Now I know how this and similar patterns are molded. I was in the foundry when the mold was made. That's the place to learn the molding business.

If I were asked the question, "How is the mold made?" and my job depended upon my answer in the case of a number of the patterns made by me, I fear my name would appear very near the top of the application list for admission to the poor house.

Now, brother pattern makers, you will admit—at least three out of five—that, if called upon to make this large journal box with its projecting side ring, you would securely fasten the rings to the sides of the pattern, and, starting from a point away down near the bottom of the ring, you would, with the aid of a nice wide and sharp chisel, or a spoke shave, or small block plane, cut a nice taper—a "cope" taper if you please—on the sides of the body pattern from the ring up, so that molder would experience no trouble in making a nice and clean "cope" lift, provided, however, the mold was made in this way. If the molder decided on another way for doing the job, why, that's his funeral, you predetermined the molding operations, so why worry?

The pattern here described is commonly known as a pillow block. The shaft bearing projects beyond the main casting on both sides, and this projection which is only a half circle is what is described as the side ring. It forms a ring when the top half is bolted on, hence its name. When molding it the ring projects out from the portion of the pattern which is under the surface of the mold thus making an ugly lift if a solid pattern is used. Bore prints and stop-off cores are sometimes provided, but on account of expense, are not generally specified.—Editor.

In the sketches are shown, in two views, a broken section of the pattern in the mold. Fig. 1 is shown with the side of the flask removed, Fig. 2 a section through the middle of the flask mold, and pattern. The pattern was made with the rings, or ring sections, loose. I was not quite sure as to just how the molding would be done, so by making the ring sections loose on the body pattern I thought I would be playing safe, in other words I was doing considerable "thinking" and "guessing."

Instead of "coping" or "cheeking" down to the ring, as I thought the molder would do, dry sand cores were laid on the pattern, part way around, and rammed up in the (drag) mold. These slab cores were not placed all the way around the ring, but just far enough from each side of the top centre to make a good support for the overhanging sand. The mold below these slab cores is made in green sand. After these slab cores are set in the mold over both rings sand is shovelled in, rammed, etc., in the usual manner.

It will be noticed that the whole pattern is molded in the "drag" flask. The "cope" is a "flat back," a plain flat cope with no part of the mold projecting "up" into it. After the mold is completed the cope is lifted, the pattern drawn out, leaving both ring sections in the mold, these ring sections are afterwards removed from the mold by drawing them "in" and "up" through the space forming the body.

The reader will readily understand why these slab cores are used, in the mold just above the ring where the section is very thin.

This molding method makes it possible to mold the whole pattern in the drag flask. Now, let us consider the making of this pattern and the molding from another angle.

What would happen the pattern maker who is not familiar with the methods used in the molding of this and similar patterns if the ring sections were securely fastened to the body patterns with glue and nails or screws? Would the molder return the pattern to the pattern shop where the pattern was made, to have the ring sections removed and then replaced, "loosely" held in place with dowel pins, or would the molder proceed to do this job himself right in the foundry? Not if he was thoroughly posted in modern molding methods.

Pattern makers should be interested in this bit of molding practice.

In the case of a pattern having the ring sections securely fastened on the sides of the body pattern, this pattern would be taken to the core maker who would place the pattern with the ring

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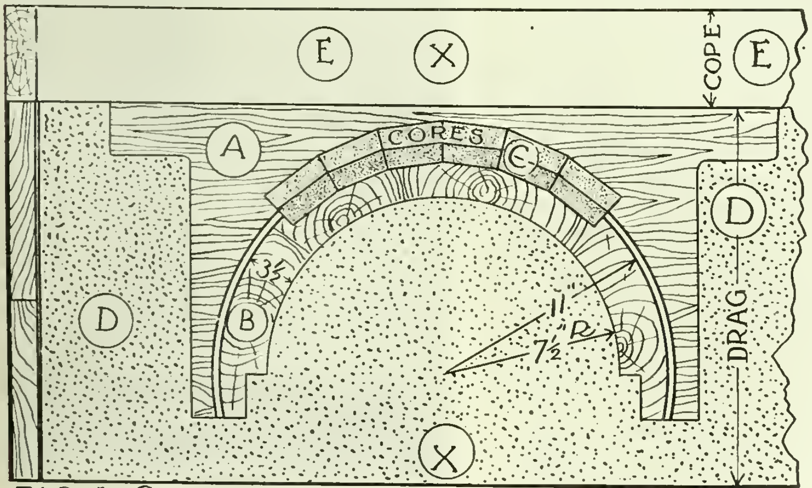


FIG. 1 SHOWING MOLD WITH SIDE OF FLASK REMOVED

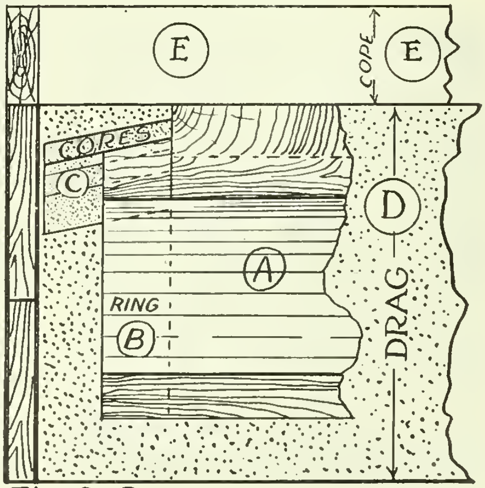


FIG. 2. BROKEN SECTION AT X.X. FIG. 1 SHOWING CORES

PATTERNS AND CASTINGS

By W. P. ESSEX

Searing the Surfaces of Patterns, An Old Practice—Some Practical Applications of the Searing Irons

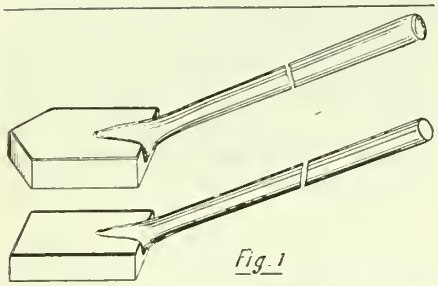


Fig. 1

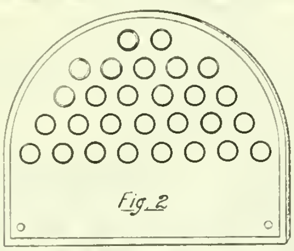


Fig. 2

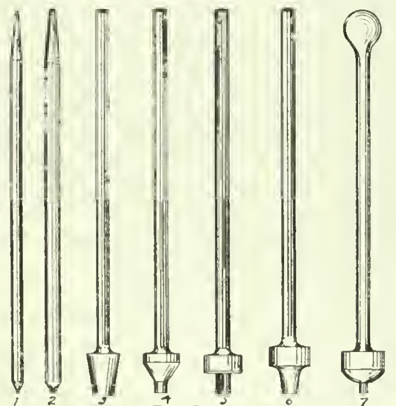


Fig. 3.

THE writer has often been amused at the peculiar appearance, and the variety of finishes on some of the odd-job patterns that have at times been brought to the works' foundry for castings to be made from, often without any protective covering or finish whatever, and this is preferable without doubt, to a coating of sticky paint or gummy varnish, with which many of these outside jobs are sometimes plastered. Occasionally we have noticed excellently made patterns, their workmanship bearing evidence of mechanical refinement and skill of no mean order, but which seemed from their appearance to have been subjected to some pyrogenous finishing treatment, instead of the regular sand paper and shellac finish. One day the acquaintance was made of the originator of some of these "sugi" specimen patterns, who enlightened us, and we learned that the charring or searing of the surfaces of wooden patterns to close and harden the grain of the wood, was a practice that was sometimes followed by the old English millwrights, who in those days were also the patternmakers. The process consisted of going lightly over the plain portions of the pattern with a hot flat faced iron similar to those shown in Fig. 1. The irons were heated to a dull red, on a forge or in any clean fire, before applying to the pattern the iron was cleaned with a file or rubbed over a flat stone to remove the scale from the face. The iron was then passed rapidly over the surfaces of the pattern, sometimes with a slight rotary motion, without burning or charring the wood. No further finish was given to the pattern, which after the searing treatment presented a peculiar mottled appearance. It is almost needless to remark, that while the searing treatment smoothed down the rough and uneven portions of the pattern it afforded no protection against moisture and consequent warping.

With the tools and equipment now at the patternmaker's service, bevel and uniform surfaces are obtained without resorting to such methods of finishing as searing. There are, however, occasional jobs where round holes of various forms such as tapers, counterbores, and countersinks are required in patterns, where burning irons can be used to good advantage, in fact, in many instances there is no better method of finishing holes in patterns where clean self delivery from the sand is required, than with the searing iron. As an illustration the writer calls to mind a pattern made some years ago in a shop poorly equipped for pattern making being practically devoid of woodworking tools and machinery. That portion of the pattern that we wish to refer to is shown at Fig. 2. This was a large plate about 1¾ inches thick, through which in the upper part of the pattern the drawing called for twenty-eight holes 2¼ inches in diameter with a ½ inch taper to one foot. The holes were bored with a brace and expansion bit. How to taper and smooth them was another question. It was finally decided to try the searing stunt. The blacksmith was appealed to, and he made a good job of drawing down the end of a piece of 2 inch pipe to the required taper, the pattern was taken down alongside the forge, and in less than an hour the holes were tapered and smoothed to perfection. A few checks resulted in the wood from the heat of the burning iron, which might have been avoided had more time been taken between the searing operations.

In shops where only large work is carried on such as engine and machine tool patterns, there is only occasional opportunity to make use of the burning irons, but on medium and small work like domestic and farm pumps, agricultural machinery, patterns for articles in malleable iron, and hardware lines, frequent use for the searing irons can be found. On patterns for furnace and stove plate work they are almost indispensable, and are in more or less frequent use throughout the day.

On the Use of Searing Irons

A number of the most familiar and useful shapes of searing irons are shown in Fig. 3. These should be made in different sizes to suit the peculiar requirements of the shop's work. They may be

Fig. 4.

made of wrought iron with handles about 18 inches long, the searing ends should be turned on a lathe to the required shape. The first four shown in the illustration are the forms most generally used. No. 9 is an iron that was especially made to finish half-round holes, a large number of which were necessary in some disc patterns made by the writer a few years ago. To obtain the best results when searing holes in wooden patterns, the iron must not be applied to the work too hot, or be in contact wi h the wood for more than a couple of seconds at a time. This is best accomplished by holding the handle of the iron between the palms of the hands as shown in Fig. 4. In this way a reversing rotary movement can be given to the iron, and a quick down and up contact with the holes, this to be repeated until the proper form and size is obtained. The holes require very little finishing if the searing is properly done. A piece of fine sand paper rubbed across the holes on the top and bottom, to remove the ring of charred wood that usually forms, and the dust brushed off is all that is necessary to be done before applying the shellac.

SOME POINTERS ON CIRCULAR SAWS

The following information and advice compiled by the Oliver Machinery Company will be of interest to those in charge of wood working machinery, more particularly circular sawing as employed in pattern shops and similarly important institutions.

"Keep your Tools Sharp," is an old adage, and this applies not only to all distinctive woodworking tools, but likewise to circular saws, band saws and machine knives. First of all, a sharp tool or a sharp saw will do its work far better than a dull one. Everyone who has had experience in handling tools knows perfectly well that much faster and better work will be turned out, using a sharp chisel, a keen edge plane, or a well filed saw than will otherwise be possible. Thus, a chisel with a razor-like edge will cut its way through a piece of wood almost as easily as through a lump of cheese. In dressing a piece of lumber a sharp plane will not scrape the surface, leaving it streaky and uneven to the touch (as usually happens with a dull plane), but leaves the wood clean, smooth and silk-like in appearance. If you take a saw in good trim it is simply amazing to see with what ease it eats its way through the lumber. It is a real pleasure to handle tools that do their work efficiently and well.

A circular saw with teeth in perfect round, uniformly spaced and uniformly shaped, with gullet outline affording the proper hook for the wood being sawed, and with the teeth evenly set or swaged, according to the manner of fitting employed, will eat its way through wood several inches thick as easily as if passing through a piece of pasteboard. On the other hand, if the teeth are dull they will merely scrape their way through, leaving a rough, ragged, sawed surface. If some teeth are longer or shorter than the average, there will be marks or scratches and the roughness may be such that excessive planing or surfacing will be necessary when the wood moves on in the next step toward final conversion. Again, if the saw contains lumps, ridges, bends or twists, there will result heating and increased distortion of the blade, burning in spots, with impairments of the temper, some portions of the saw showing black on one side, while on the opposite side the lump stands out, brightly polished by frictional contact in the cut.

A dull saw can never produce a clean, smooth sawed surface, and it is, therefore, of the greatest importance that suitable fitting tools and machines shall be available for use in shops of every decription where circular saws are employed. Unfortunately, there are a good many so-called practical men, whose attitude is "I can't afford the time necessary to sharpen my saws and tools. Such jobs must be gotten through with as quickly as possible," and the bad results from this lack of interest and attention explain why the mechanics in shops are sometimes called "wood-butchers." The difference between a good and a poor mechanic is not always the matter of superior skill, but it is largely due to the interest, care and attention bestowed on work in greater measure by one man than another.

A manual training school should afford instruction in saw fitting, to some extent at least, and should preferably be equipped with a suitable complement of appliances whereby saws in every day use may be well kept up.

HOW LARGE JOURNAL BEARINGS SHOULD BE MADE

(Continued from page 35)

section down on an iron drying plate, the space between the body of the pattern and the iron plate would serve the same purpose as a core box. Core sand is filled in all around the ring and flush with the top, or cope face, of the pattern and extending out from the sides of the pattern, say 3 or 4 inches to rest on the green sand at the bottom of the mold. Two of these cores are required.

The pattern is placed in the "drag" flask, bottom side up and flush with the top of the flask. Sand is filled "in" under and around the pattern up to the top edge of the ring. At this point the molding is stopped, the large saddle cores placed in position in the mold on top of the rings.

The filling in of the sand is now continued and the "drag" flask finished ready for the cope flask. The "cope" flask is now placed on the drag, sand is filled in, rammed and the core finished in the usual manner.

The cope is lifted, the cores lifted out, next the pattern is lifted out, the mold finished, the large cores returned and set in the mold, the cope put on the drag, the flasks clamped and the mold is finished ready for pouring of the iron.

CORES AND COREMAKING PRACTICE GOOD AND BAD

(Continued from page 34)

troublesome to tap. But the worst part of it was that in ramming the core, instead of a solid block to ram against there were upright partings all around which were of green molding sand which had to have parting sand or some other kind of parting to prevent sticking to the coke. It is a difficult proposition to get anything to stick on such a place, and as a result there were very few good lifts, even when a good molder had the job. Good molders were not much encouraged in that shop any more than in the former one, and as a consequence the unskilled man was called upon to do what a practical man would have had trouble with.

These two extreme cases show how cores are misunderstood by people who hold positions which call for ability of a high order. Cores are valuable but they must be used where their value has a chance to display itself. I have seen gap lathe beds made with green sand cores, when I am confident that a day or more of time could have been saved by drying the cores, and the risk greatly reduced. And I have seen other instances where great big jobs have been done, and the entire mold put in the oven and dried. These are also extreme ideas, showing that practically everything which is done in the average foundry is done for no real reason which has anything at its back. Slowly but surely the foundry is going into decadence as far as skill is concerned. Modern inventive genius is doing much to improve the foundry but the insane notion of exterminating the skilled workman and the apprentice is undoing it. There should be somebody in every foundry, who knows when cores should be used and when not.

CHINESE PETROLEUM WELLS

Now that a certain amount of anxiety is being felt over the likely shortage of gasoline in the near future it may be of interest to note that there is petroleum in China.

A recent investigation shows that China possesses petroleum wells in the following provinces:

Chihli, 22; Kirin, 2; Yunnan, 17; Kiangsu, 5; Hunan, 4; Szechwan, 3; Kwangtung, 1; Fengtien, 4; Kweichow, 13; Shensi, 8; Kwangsi, 4; Kiangsi, 4; Hupeh, 2.

The total throughout the country is 91 wells, the best of which are in Chihli, Kweichow, Yunnan and Szechwan.

Questions Relating to the Brass Foundry

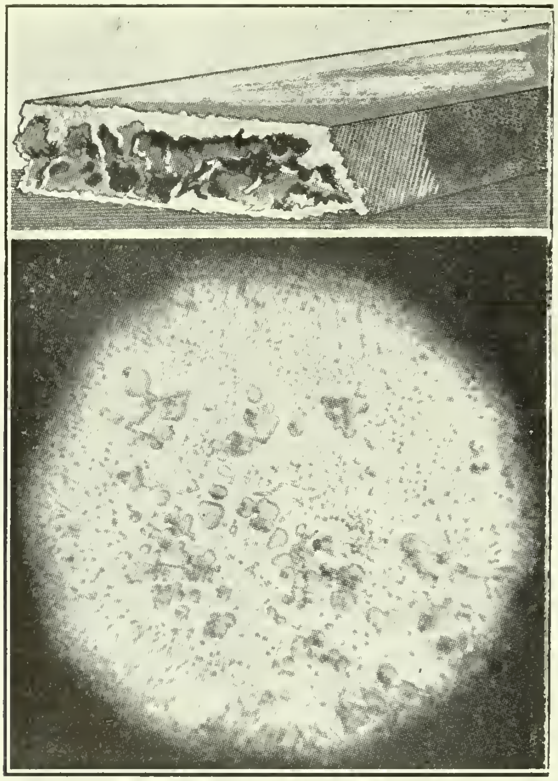
WANTS COPPER CASTING DIAGNOSED

Editor, Canadian Foundryman:

We are enclosing under separate cover a sample of a light copper casting which we made. We should be pleased to have your advice as to whether you think the fault lies in the moulding or whether the copper itself is of a poor quality. Would you consider it was virgin copper, or is it scrap remelted into pig?

Answer:—Your trouble is in the melting. It has always been considered by the best metallurgists as well as foundrymen that to make a clean sound copper casting was a physical impossibility. No matter how carefully the copper is melted it will oxidize as soon as exposed to the air. Even when passing from the lip of the crucible to the mold it will absorb a considerable quantity of oxygen. There has not been any method of melting developed by which some oxygen is not absorbed. When copper is carelessly melted it absorbs more. You do not state how you melted your copper, but it has evidently been exposed to more than its share of air. If the metal did not show itself impure before melting it would not matter if it had been remelted scrap.

There are various ways of dioxidizing the melted copper so that it will pass requirements. Copper oxide not exceeding one-half of one per cent. is considered clean copper. Silicon is probably the best dioxidizer and can be bought in the form of silicon copper. Zinc in a very small quantity will carry off the oxygen, but if your contract is such that no metal can be included excepting copper it, of course, can not be used. Two ounces of zinc is sufficient for one hundred pounds of copper, and most of this small amount will go to the top with the oxygen. There are fluxes on the market which will dioxidize any metal and will save you a lot of worry. There are precautions which should be taken in melting any nonferrous metal, the principal one being to keep the air from the metal. Before charging on the metal put a handful of salt in the crucible, and after the metal begins to melt cover it with pulverized charcoal. When pouring just skim the scum back enough to let the metal out and then after lowering the lip to as close to the gate as possible, pour rapidly and keep the gate full.



Upper picture is how copper casting appeared. Lower picture shows how it appeared when enlarged.

In the illustration will be seen your sample at the top and an enlarged photograph of it underneath. Your metal is carrying, what the chemist would call 3.46% Cu_2O whereas 0.5% Cu_2O is the maximum allowance. If translated into foundry English this means that on account of the melted copper being exposed to the oxygen in the air, it has become oxidized to the extent that it is carrying almost 3½ per cent. of an impurity which consists of copper 2 parts and oxygen 1 part.

We strongly recommend having your metal analyzed by a practical chemist to give you all its chemical characteristics. That is equally advisable in iron as in copper or alloys.

REMELTING TURNINGS

Editor, Canadian Foundryman:—Would you please answer the following question in your next issue if possible? We have a quantity of Allan metal turnings that we wish to melt over. Is it possible to re-melt them in a brass furnace, and if so, how is it done?

Answer:—Allan metal is a trade name for an alloy of copper and lead for which the manufacturers claim a patented process of mixing. Since these two metals melt at such vastly different temperatures and are of such a different specific gravity it would be quite a difficult matter to prevent them from disintegrating and the lead settling to the bottom before the copper had time to solidify, but if this has been overcome by some process so that it can be re-melted from the ingots it should be the same in the turnings.

It is not, however, good foundry practice to re-cast turnings of any alloy without adding new metal. To re-cast the Allen red metal turnings they should be free from ordinary brass, iron or babbitt metal turnings or particles, and about fifty per cent. of new metal should be used.

A crucible that has not been used for other metals should be fired the same as when casting brass. The metal should be brought up to a temperature of 1950 Fahr. and must be cast direct from the crucible into the molds.

CASTING IN PERMANENT MOLDS

I would like a little information pertaining to die casting. What composition or substance is used in the dies or metal molds? What is the composition of aluminum used? and what is the tensile strength?

Answer:—If you are not going to cast anything but aluminum alloys the molds or dies can be made of steel, but if it is the intention to use alloys containing any considerable percentage of copper, there is no metallic mold which has been successfully used. Aluminum alloy for the general run of die casting is 92 per cent. aluminum and 8 per cent. copper. This works all right in a steel mold, but for a higher percentage of copper, carborundum is sometimes used.

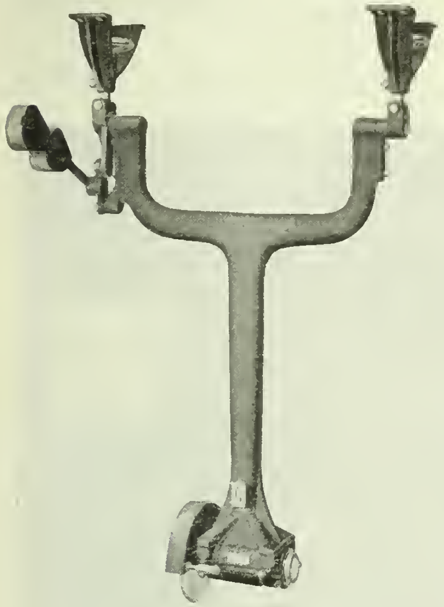
Magnesium is used extensively in aluminum alloys and adds greatly to its tensile strength. One per cent of magnesium or even half of that amount will give a tensile strength of 60,000 lbs. to the square inch.

New Equipment for Pattern Shop

NEW MOTOR-ON-ARBOR, SWING CUT-OFF SAW

A new swing saw has recently been put on the market by the Oliver Machinery Co., of Grand Rapids, Mich., which can be either belt or motor driven.

The illustration shows it motor driven. The frame is made in the cored form, with a single arm centrally located. It supports the counter shaft above, and the saw arbor frame in a tongue and groove bearing below. Length between



Swinging cut-off saw with motor on the arbor.

hangers 4 feet 2⅝ inches, from center of countershaft to base of hangers, 17½ inches. Made in three standard lengths viz., 5 feet 5 inches, 7 feet 5 inches and 9 feet 5 inches.

The arbor is made of crucible steel, machine ground to accurate size. It is mounted in two self-oil split bearings 4¾ inches long, 1 7-16 inch diameter, and carries a grooved pulley, 5 inches by 6¼ inches. End play is cared for by babbitt grooves in the front bearings; speed of arbor 2000 R. P. M. Length 24 inches and diameter 1¼ inch where the saw is applied. (I inch on Motor-on-Arbor.) Adjustment for tightening the belt is 1½ inches.

The arbor frame is detachable from the main frame, held securely in position by heavy bolts. It is adjustable vertically for taking up stretch of the belt, and may be removed from frame for rebabbitting the bearings. A strong handle bolted to this frame is very convenient for the operator.

The shield is made of cast iron, bolted to the frame and need not be disturbed when removing the saw.

Motor Drive

Two types of electric motor drive can be furnished—Belted Motor Drive and Motor-on-Arbor type. Belted Motor Drive consists of mounting a 5 H. P., about 1800 R. P. M. motor on a bracket in the yoke of the machine in place of the countershaft and belting down to the saw arbor. Motor-on-Arbor can be furnished only for 2 or 3 phase, 60 cycle, 220 or 440 volt A. C. and consists of a 3 H. P., 3600 R. P. M. shaftless motor built-in directly on the saw arbor, fitted with Ball Bearings and 16-inch diameter saw with guard and handle. This motor-on-arbor drive is extremely efficient, very dependable, absolutely safe, and requires minimum care.

18-inch saw will cut planks 12 inches wide, 6 inches thick; 16-inch saw will cut planks 12 inches wide up to 4½ inches thick; 24-inch saw will cut planks 12 inches wide up to 9 inches thick.

SOMETHING NEW IN A BAND SAW

J. D. Wallace & Co., 1401-1417 Jackson Bldg., Chicago, Ill.. announce that they have just placed on the market a new 16-inch bench band saw, herewith illustrated.

This machine has a number of features not generally found in a band saw. It is equipped with disc steel wheels, which are durable, accurate and have a large factor of safety. It is equipped throughout with ball bearings —even the upper and lower guides are of the ball bearing type, the saw bearing on the periphery of the roller.

Another very attractive feature is the totally enclosed electric motor, which is built into the machine and directly connected to the lower wheel by a fabroil gear and steel pinion. Both gears run in oil to insure perfect lubrication and a quiet running machine. The centrifugal force throws this oil into the bearings and keeps them well lubricated.

The table is flattened and is of ground steel plate 19 by 21 inches. It is mounted on a large rocker bearing, which is adjusted to any angle from 45 degrees to minus 5 degrees. An indicator is provided to show the angle at which the table is tilted. The table is mounted in a very simple manner and can be taken off easily and quickly.

Safety guards are built into the machine and are a standard part of it.

All adjustments are controlled by hand wheels or thumb screws, without the use of special tools or wrenches.

The height of the new Wallace Bench 16-inch band saw is 5 feet 9 inches over all; the table is 42 inches from the floor; floor space required is only 15 by 29 inches. The motor, a ½ horse-power general electric, is ball bearing, and runs at 1,750 revolutions per minute; the saw runs at 3,150 feet per minute.

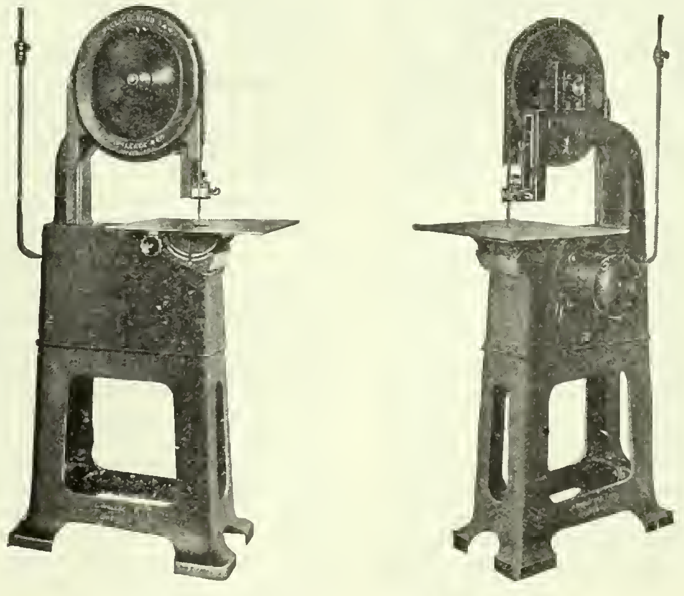
The blades used are especially made for this machine. They are of special steel properly treated and especially cut so as to serve the greatest number of producing hours on this size wheel. The company guarantees these blades to give absolutely satisfactory service.

Practically every wood working plant and pattern or carpenter shop can use one or more of these small band saws to advantage and there are many places where a band saw of this size and character will fill a positive requirement.

It is totally enclosed—assuring safety to the operator. It is portable and operates on electric light circuit, so you can take it to the job, saving time, labor and power. Easy, quick adjustments assure extreme accuracy, and it will handle any stock from the smallest pieces to the hardest wood 8 inches thick.

A very high grade band saw is thus available at a very moderate investment—a machine which will handle from 80 per cent to all of your band sawing, turning out better work more rapidly and at less cost.

The manufacturers will send descriptive bulletins to those interested. Please mention this publication when writing.



Two views of Wallace 16 inch bench band-saw.

The Osborn Stationary Flask Filling Machine

Fills Flask With Sand, Saving Much Time Over Old Method of Shoveling it in by Hand—General Description of Machine

TEN OR fifteen years ago the foundry industry in regard to labor saving equipment was in a condition not much better than three hundred years ago. Since that time, due largely to the fact that so many very capable engineers have turned their attention to this field, many labor saving and quality increasing devices have been perfected and placed at the disposal of American foundrymen.

This list includes sand cutting machinery, mixing machinery, conveyors for all possible uses in foundry, pouring devices, cupola loading devices, shake out machinery, foundry, equipment, moulding machines, etc. When this vast array of machinery is considered, it seems hardly conceivable that anything could be added, but this is not the case.

For some years past it has been evident that there was a constantly increasing demand for a machine which would be capable of taking the sand from the floor and placing it in the flask on the moulding machine. It has been the general practice to convey the sand to a hopper located above or to one side of the moulding machine, the sand then being discharged into the flask by means of clam tight discharge gates.

This method of discharge left many things to be desired, since the sand discharged by this method was found to pile high in one place, requiring distribution to the entire surface of the flask.

In addition, this type of sand handling equipment was necessarily running the full length of time the foundry was in operation and was quite prone to break down. This was apt to hold up production of one or several floors, and sometimes of a whole foundry.

Early in 1913 the engineers of The Osborn Manufacturing Company, developed the idea for filling flasks, as shown in the accompanying illustration, but due to the fact that they had more work than they could do in the building of moulding machines, they were prevented from building the flask loader.

Late in 1921 the first machine was built and has been installed in a foundry. After closely observing this machine at work for many days there can be no doubt as to the advantages to be had by the use of it.

The actual operating tests of this Flask Filling Machine read almost like a page from "The Arabian Nights." These tests were conducted with the outfit shown in the illustration.

It took two men one and one fourth hours to shovel sand into the flask, while with the machine this work was done in one and three fourths minutes. This means that on every mould produced there is a saving of time of over one hour which, of course, permits a greatly increased production from each moulding machine.

The loader illustrated is of the self-contained stationary type which stands alone without other support. It is planned to make a portable model also, which will permit one flask loader to move from moulding machine to moulding machine.

A point of great importance about this machine is the fact that, except while it is actually elevating and discharging sand, it may be completely shut off.

This is not always true of sand handling equipment. Taking an eight hour day as a basis, the machine illustrated will be in operation only about forty minutes, so the fact that it can be at complete rest the other seven hours and twenty minutes is readily appreciated to be of very real importance.

General Description

The machine is made up of structural shapes with suitable mechanism at each end of it for supporting sprocket wheels, upon which are mounted standard link chains. Special shaped buckets are attached to the chain in the manner indicated on the drawing. In case of a stationary machine (which is the one illustrated) the entire outfit is self contained and stands alone without support.

At the upper end of the machine is attached a flexible discharge chute, so located that sand may be discharged in all the corners of the flask.

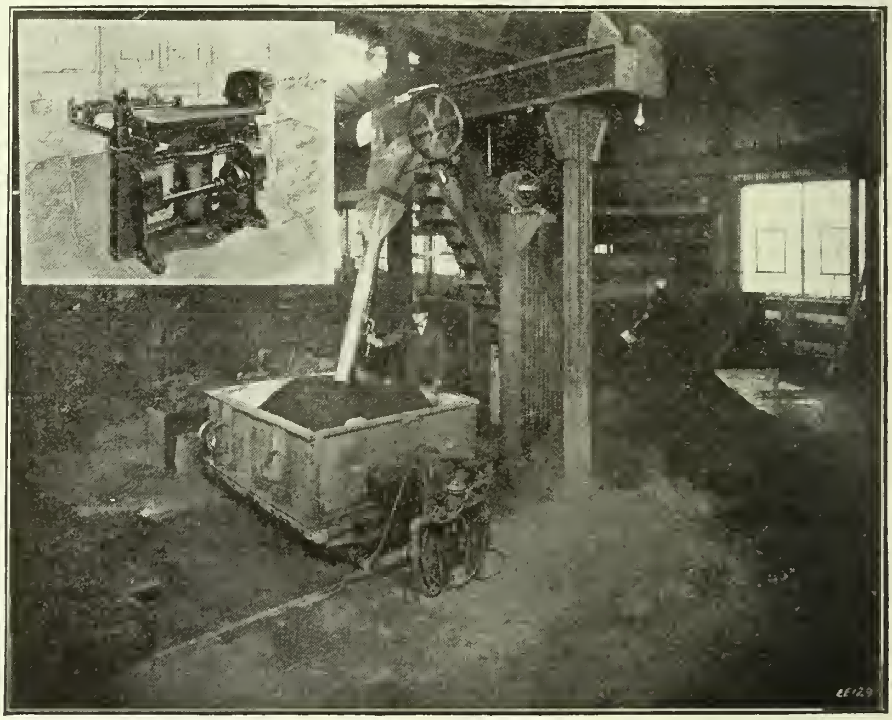
The machine is driven by an electric motor, the capacity of which depends upon the amount of sand to be handled. Two cubic yards of sand per minute require a 15 h.p. motor.

It can be had either portable or stationary.

The motor is controlled by a push button located on the end of the discharge chute.

The machine is designed to operate only during the length of time necessary to fill the flask. this time, of course, varies on the different machines, but on the 407 Roll Over Machine the flask loader will handle two cubic yards of sand per minute, which in most cases is sufficient to fill the flask.

The starting and stopping operation is under control of the operator, it only being necessary to push one button for starting and another for stopping.



The Osborn Stationary Flask Filling Machine.

Position in Floor

It may be either placed so that the receiving buckets will be at the floor level or below the floor. Where possible, the machine should be located several feet below the floor with an open grating at the floor level, and an opening provided between the flask loader and the foundation pit.

It is intended that as the sand is being cut by a sand cutting machine, that it gradually be worked into a heap around the sand loader, where preferably a clam shell bucket could be used to good advantage

Capacity and Performance

The machine illustrated is capable of handling two cubic yards of sand per minute. In the case of a large flask, as shown on the machine in the picture, it takes two men one hour and a quarter to fill the flask by hand. By using a machine this work is done in about two minutes. This cuts at least an hour from the time taken to make each mould.

One of the very advantageous features of this machine, in addition to its ability to elevate and evenly distribute a large amount of sand in a very short time, is its easy control. The entire mechanism is operated by a push button, located at the end of the discharge chute and immediately under the thumb of the man working the chute. When the machine is not actually elevating sand it is entirely shut off, thus eliminating a great deal of wear and tear encountered in the ordinary equipment for handling sand.

A big moulding machine, operating to capacity with this flask, can produce let's say twenty moulds a day. This will call upon the flask filler for just forty minutes of work, so the easy and complete control is very apparent.

Some actual figures, comparing the work possible with and without this flask loader, are very interesting. When working the outfit shown in the picture, it was found, as has been stated, that it took two men one hour and fifteen minutes to shovel the sand into the flask. With the flask filling machine this work was done in one and three fourths minutes.

Actual tests, conducted under normal working conditions, demonstrated that when the sand was shovelled by hand, it was possible to turn out five moulds a day, while with the flask filling machine this production could be increased to fifteen moulds. These tests were performed with the outfit in the illustration.

New Style Power Sand Cutting Machine

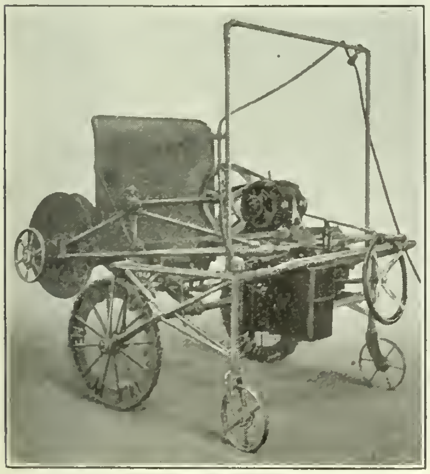
Saves Labor, Cuts the Sand More Uniformly, Thereby Making it Possible for the Molder to do Better Service

CUTTING over the sand heaps with a machine would have been looked upon with derision a few years ago, but it has now become one of the details of the foundry which every energetic foundryman realizes must be a part of the everyday programme.

Needless drudgery is a blight upon any industry. The foundry industry in particular has suffered incalculable losses through the dead-weight of exhaustive physical labor. Machine illustrated is one of the types manufactured by the American Foundry Equipment Co. of New York and the description of it will be of interest.

How It Operates

Ten steel shovels (blades) arranged in a cylinder revolving 150 times a minute (50 cuts per lineal foot), slice, toss, and mix the sand, forming it into a ridge or windrow, all at the rate of fifteen feet of floor length per minute. This would probably take a man fifteen minutes. By repeating the operation the sand can be kicked back against the wall or molding machine. One sand cutting machine replaces several laborers. The sand is also said to be cut and tempered more evenly thereby producing better castings.



Power sand cutting machine—Type HP.

More Production—Less Discount

If a molder can put up several more molds per day with machine-cut sand, that is a definite gain for both molder and employer.

A decrease in the percentage of scrapped castings is another definite gain for both.

Experience among practical foundrymen proves that the Sand Cutter accomplishes both, because:

Machine-cut sand has the same consistency every day.

It contains no hard clods, nor wet or dry spots, to cause scabs, drops, run-outs, or blows.

Machine cutting thoroughly blends new sand with the old. It is "lost" in the heap.

Machine-cut sand vents better because it is exceedingly fine, light and uniform and it molds faster, and the molder uses all his time for making molds.

Molders can depend upon finding their sand cut, hot weather no exception.

Standardizing the Foundry

A foundry can be a jumble of confusion or a model of system and order. Many sand cutting machine users say the machine is one of the best means of standardizing and systematizing the foundry because its use practically forces early clean-up of floors, orderly floor arrangement, clear gangways, neat stacking of flasks, boards etc. The sand is left in shapely windrows or neatly piled where wanted.

Sand cutting machine in operation.

The Molder's Viewpoint

Though labor is no longer scarce, good producers are and always will be. A good producer, ambitious to earn, seeks conditions under which he can produce and earn the maximum. The intelligent molder wants machine-cut sand, and what is good for his pocketbook is good for his employer's too.

Molders know that the Sand Cutting Machine lightens their labor and increases their earnings through larger and finer production.

The foundry that can attract and hold steady, contented, ambitious molders is fortunate. It is always a money-maker.

OVERHEATING IN FACTORIES

The commonest evil in air conditioning in factories, says the U. S. Public Health Service, in a recent report, is the slight but highly objectionable overheating which obtains in ordinary window-ventilated workrooms where there is no marked crowding and no special process tending to overheat or vitiate the air. This evil can commonly be controlled by watching the thermometer, by common sense regulation of the artificial heat supply and the use of windows before and during the shift.

Heat hazards of high degree can not be summed up so simply. In cool weather, says the report, they can be adequately controlled by properly designed and operated systems of fan ventilation; but in summer time, although they can be mitigated by ventilating systems that produce vigorous air movement, they cannot be fully controlled except at prohibitive expense and must therefore, in general, be accepted as an unavoidable incident of the employment. The effects, however, may be minimized by short spells of work alternating with rest periods.

Who's Who in the Foundry Supply Business

What Has Been Accomplished During the Last Three Decades Towards Supplying the Wants of Canadian Foundrymen With Canadian Goods

HOW things have changed in the last few years in the foundry business, particularly in Canada, may be judged from the following facts jotted down from the experiences of some of those who were most familiar with the subject. Thirty years ago there was not a place in Canada which catered to the foundry trade; there was not a paper published on foundry business and no means whereby those who might be expected to supply Canada's wants from abroad could make the fact known. Every thing was a secret. If a foundryman happened to know where he could secure a good article he did not want his competitors to know it.

As a matter of fact there were not very many supplies which could be secured ready to use, as the custom was for each concern to prepare its own. Black lead could be secured, but it had no bond and each foundryman had his own secret process for putting it into working order. This, however, was too expensive a material to be used on anything but the most particular class of work. For most of the work, flour was shaken on first and then charcoal dust. This had to be well sleeked down to keep it from peeling off or washing off before the flowing metal. Each foundry had to have a blackening mill for grinding the blacksmith's coal into sea coal and for grinding the charcoal. When no one knew any better it was good enough, but the castings which were turned out in those days would not stand inspection now, although most of the old timers will endeavor to remember those days as better than the present.

About the time that prepared blackening became procurable, a company by the name of N. R. Mudge started in Montreal and produced one brand known as carbonized lead. This was good material but was so sticky that it had to have charcoal dusted on top of it before it could be sleeked. But the drawback was to know where to get the supplies. If a new foundry was started the proprietor had all of this to find out. If he located N. R. Mudge he could only get one product there.

Merchandising molding sand was not common practice. Each community was supposed to supply its own sand. Coal for melting was bought through the local coal dealer, while the wholesale hardware merchants would import pig iron from Scotland for anyone who required it but they had to be allowed a couple of months in which to deliver it.

In time the foundry supply business became a real line in the United States with Cincinnati as a leading headquarters.

Business Starts in Canada

About thirty years ago, (thirty-one to be exact) some energetic citizens thought the time opportune to manufacture foundry facings in Canada. A company was organized in Hamilton, Ont., which developed into the Hamilton Facing Mill Co. of to-day.

* * * *

THE HAMILTON FACING MILL CO.

Thomas Reid, the managing director of The Hamilton Facing Mill Company, was born in Dundas, Ontario, and received his education in the schools of that town. He was articled as an apprentice in the foundry of The John Bertram and Sons Company and as early as 1877, at an age that constitutes a record for youthfulness on holding such a position, he was made foundry superintendent of the same foundry. He held this position with The John Bertram and Sons Company for the following fourteen years.

In those days the foundries were not highly specialized plants as they are today with all facilities for handling work, such as overhead cranes, stock patterns, iron flasks, etc. The character of the work was so carried that men were called upon to work in either green or dry sand and to build up a piece of work in loam. Many a splendid piece of work was done in the old Bertram foundry by drying the mold in pits or on the floor owing to lack of crane and other facilities.

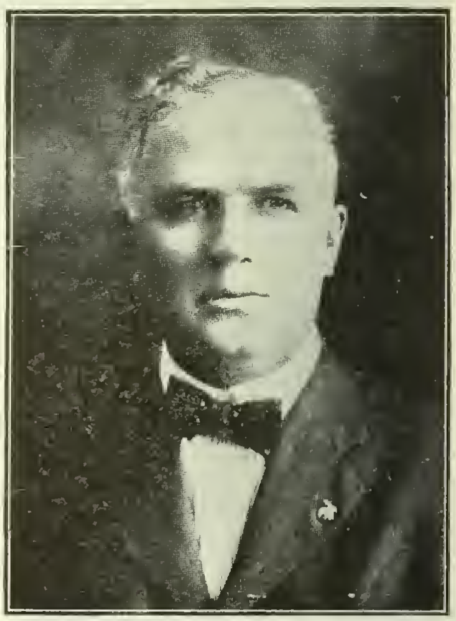
In 1891 in company with the late James Thomson, for many years the well-known president of the Gartshore Thomson Pipe and Foundry Company and J. G. Allan, the present president of the Gartshore Thomson Company, Mr. Reid established the Hamilton Facing Mill Company to take care of the requirements of the Canadian foundryman. Up to that time there had been no alternative but to import all facings from the United States. For some time the business grew rather slowly owing to the fact that there was no protection against the American grinders but in 1896 a slight measure of protection was granted and since that time the progress of the business has been steady, continuous and solid.

When the mill was first built in addition to the latest crushing, grinding, drying and bolting machinery which could be got there was also installed a tube mill, one of the very first f n the first of its kind on the continent. The original size of the building was 80 ft. by 50 ft. and was in those early days a venture of faith.

This equipment has since been doubled in order to allow of the greatly increased business being handled expeditiously. The mill was also so built and the machinery so installed as to allow of all material, after drying and crushing, being hoisted automatically to the mixing floor and from that time on the process is one of gravity, the material finally reaching the finishing stages on the lowest floor. Several years ago it was found that the old system of bolting did not give a product as rigidly uniform as was desired by this company who had always specialized in as nearly perfect a product as was to be had. As a result there was installed a complete air-float of the largest size and the most up-to-date type. To-day the pro-

THOMAS REID

At the time of leaving the foundry to enter into business in 1891.



George Herbert Weaver, President Dominion Foundry Supply Co., Montreal.

C. H. Woodison, Vice-Pres. E. J. Woodison Company Gen. Mgr. E. J. Woodison Co., Ltd.

E. J. Woodison President

J. C. Woodison Secretary

duct is guaranteed absolutely uniform in every barrel and all chance of the operator affecting in any way the uniformity of the product is removed. In addition to this the whole works stand to-day as one of the most complete and up-to-date on this continent as well as comparing with the American mills in the output capacity.

From the outset the policy of the company has been that of supplying the best possible product at the best possible price. The whole policy of the company throughout its thirty years has been directed to that end and the fact that The Hamilton Facing Mill is to-day a household word from the Atlantic to the Pacific is proof that this policy has been appreciated.

In order to carry out this policy two things have been done. In the first place the raw material has been invariably imported direct from the mines. The crystaline graphite has for years past been imported from Ceylon and amorphous graphite for special lines of work is imported from Mexico. But in either case the raw material is imported direct from the mines and all work in the preparation of the raw material until it reaches the final and finished stage is done in the mills in Hamilton. In the second place the company manufactures in Hamilton every line of foundry facing which it advertises.

Frank J. Ross, Manager Toronto Branch, Dominion Foundry Supply Co.

Anything in the nature of a mushroom or unstable growth has been carefully avoided and the progress aimed at and achieved has been that of a healthy and solid growth, the building up of the business being done with an eye not only to present needs but to future opportunities.

While this company was appreciated by the foundrymen of Canada it was not to be supposed that they would have the entire country to themselves and opposition loomed up the year succeeding their organization.

* * * *

THE DOMINION FOUNDRY SUPPLY COMPANY

The Dominion Foundry Supply Company was organized and opened a business in Montreal in the year 1892 by the present president, Mr. George Herbert Weaver.

Mr. Weaver began his career with the V. W. Patterson Co. of Montreal who handled a few lines which might be asked for by foundrymen. At first he only required the assistance of one man, but the business developed to such proportions that in a short time larger premises had to be secured, and finally the large buildings which now house them were erected. In 1895 a Toronto branch was started which also developed into larger and larger proportions until the present property on Spadina Avenue was acquired three years ago.

Mr. Frank J. Ross is manager of the Toronto branch. Mr. Ross is a practical mechanic himself, having at one time been a partner in the Ross Engine Works Company of St. Catharines.

* * * *

THE E. J. WOODISON CO.

In January 1911 three Woodison brothers—E. J.; C. H.; and J. C.; began a foundry supply house in Detroit, and in November of the following year they opened a Canadian branch in Toronto with Mr. E. B. Fleury temporarily in charge. In January 1913, Mr. C. H. Woodison came over and took personal charge, which position he has held ever since.

Business soon demanded more of a staff and Mr. J. T. Hymers was taken on as office manager, which position he, also, has held ever since. Last year an office and store house was opened in Montreal with J. H. Jerosky as manager and A. E. Cambridge as engineer in charge of equipment contracts. The company now has several branches in the United States but the Canadian business is incorporated as a chartered company under the firm name of The E. J. Woodison Company, Limited, but controlled by the same offices as the American branches.

E. J. Woodison of Detroit is president; C. H. Woodison of Toronto is vice-president; J. C. Woodison of Detroit is secretary; C. D. Yahne of Detroit is treasurer. Wm. Maybank of Toronto is the Ontario representative, while W. P. Muer of Toronto is facing expert and salesman for same in Toronto and Hamilton districts.

The company prepare their own facings, partings, high temperature cements, core oils and core compounds. They contemplate a brand new establishment in the near future which, when completed, will afford them ample room to carry a complete stock and also to do their own grinding when business conditions warrant the installation of the machinery.

* * * *

E. B. FLEURY

Mr. Fleury is one of the oldest and best known foundry supply men in Canada. He has covered the Dominion from

(Continued on page 45)

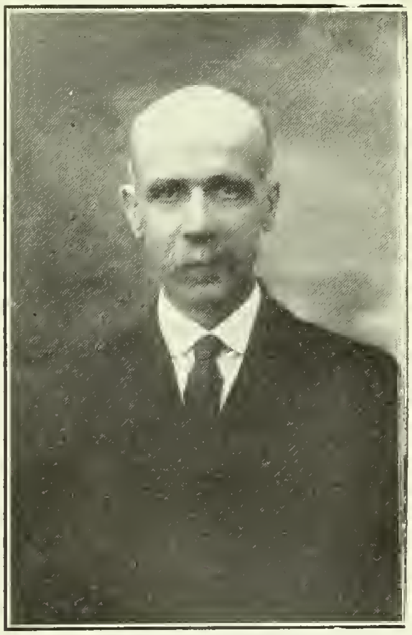
E. B. Fleury, Toronto.

Two Molders of the Old School Still on the Job

Beginning as Apprentices in a Small Foundry, More Than Half a Century Ago, the Staples "Boys" Have Remained Faithful Unto the Third Generation of Employers.

CANADIAN Industrial Annals probably contain no case that parallels the record for continuous service of "The Staples Boys" two brothers employed as moulders with The Smith Foundry Co., at Fredericton, N. B., who are rounding out 106 years in 1922 of continuous joint employment with the same family, directing the destinies of the same industry.

To make this possible, the management of the business has continued into the third generation, but it is an accomplished fact, and it is indicative of the co-operative spirit which has kept the enterprise prospering, and growing both in its expanse and the confidence of the public; so that to-day, despite the depression that has been sweeping over the business world, The Smith Foundry



Isaiah Staples, 67 years of age, began molding in 1871.

Company's plant is kept running at normal capacity, and continues to enjoy one of the largest foundry and mill machinery trades in the Maritime Provinces.

The two Staples "boys" are Fred, now 71 years old, and Isaiah, four years his junior, and aged 67. They are brothers, and were born at Nashwaaksis, a small village several miles from Fredericton. They grew up there, and in 1867, the older brother went to work in a small foundry and machine shop at Nashwaaksis, owned and operated by the late Peter McFarlane, whose name is still green in the memory of foundrymen in the Maritime Provinces. From that business, the present Smith Foundry Company developed, and the Staples "boys" have remained with it in its development, under the various managements, down to the present, which finds the president and manager of the industry, to be Harry A. Smith, grandson of the late Peter McFarlane, its founder.

The Staples "boys" are both moulders, but aside from that, about the only likeness they have, is in their regular habits, and the remarkable records both have, for seldom missing a day from their work. Fred, the older, is familiarly known to his friends as "Deacon"; his habit has been to come to work with a standup white collar; he has been dapper about his dress, and he has revelled in holding the lines over a high-headed and spirited trotter. "Bub" is the nickname by which the younger brother is known, and he is more of a rough and ready sort of chap, he has been a champion step dancer, and his fellow-workers will match him to this day, against anybody his age, and most dancers a score of years his junior.

After the late Peter McFarlane's son moved the business to Fredericton, bought out the foundry and machine business of the late James Tibbits, and amalgamated the two under the name of McFarlane, Thompson and Anderson, the troubles of the Staples "boys" commenced in earnest. Their home was in Nashwaaksis, and it is on the eastern side of the St. John river, while Fredericton is on the west back of what was known before the recent war, as "The Rhine of America."

For almost twenty years after the foundry was established in Fredericton in 1870, there was no bridge across the St. John river here, the inhabitants depending upon ferry boats to get back and forward across the river, but each fall, when the river was freezing over for the winter, and again in the spring when the break-up came in the latter part of March, or early days of April, the ferry boats were often unable to make their trips across the river. Seldom, however, did the conditions prevent the Staples "boys" with their indomitable spirit, from getting to work in the morning and getting back home at night, although some times they virtually took their lives in their hands, and, like Eliza, in the "Uncle Tom's Cabin" productions, they crossed the river on the floating cakes of ice.

Fred Staples was for twenty years, foreman of the moulding shop, where his experience made him one of the recognized experts in the moulding trade in Easter Canada, while "Bub" was one of his first lieutenants.

In 1912, the older brother was the victim of an accident, which it was at first feared, might cost his life. While superintending the pouring of some hot metal in the moulding shop, a piece of moulten iron splashed, and struck him in the face. This accident resulted in the loss of his right eye, and materially lessened the sight of the other, so much so, that he felt he was unable to continue as foreman. The position was offered to his brother, Isaiah, but "Bub" didn't want the job, so he and Fred, too, carried on as workers in ranks, and they still are working away in the moulding shop.

In July of this year, Fred Staples will have completed 55 years service, and Isaiah Staples, by June, will have rounded out 51 years.

Meanwhile, the business with which they have loyally worked, has undergone some changes, although remaining under the direction of the same family.

Fred Staples, 71 years of age, began molding in 1867.

Some years after the firm of McFarlane, Thompson and Anderson was formed in 1871, Mr. Anderson died, and his share was purchased by the other members of the firm. They continued the business under the same name until 1908, when the last surviving son of the late Peter McFarlane, the founder of the business, died, leaving his interest to his three nephews Messrs. Percy, Albert, and Harry A. Smith, who re-organized, and bought out the share owned by Frederick P. Thompson now of the Canadian Senate and prominent in industrial and political affairs, and a friend and colleague, of the late Hon. A. G. Blair, his brother-in-law.

The re-organization of the business which followed, preceded a series of serious misfortunes. In 1911, most of the plant was destroyed in a disastrous fire, but was soon re-built, and the name changed to "The Smith Foundry Co., Ltd.," This was followed by the death of one of the brothers, Percy, after an illness extending over some months.

Messrs. Albert and Harry Smith, continued the management of the business with their associates in the new company that had been formed, and when the war broke out in 1914, and Canadian industries were called upon to devote their energies to the winning of the struggle for Democracy, it was not long before The Smith Foundry Company's plant was turned into shell-making works. So much energy and effort, did Albert Smith, who was the mechanical superintendent, put into the manufacturing of munitions, that he overtaxed his health, and in 1916, he died after a few days illness—just as much a war casualty, as the men who were shot down in "No Man's Land," or hit by German snipers in the front line trenches.

Harry A. Smith, continued as president and manager of the business, after his second brother's death, but Ashley A. Colter a civil and mechanical engineer, and graduate of the University of New Brunswick, then came into the business as secretary-treasurer of the company and soon assumed the duties of the plant superintendent, for which he was exceptionally well fitted. The other chief officer of the present company is W. D. Gunter, one of Fredericton's most progressive young business men and manager of a lumbering business, with a mill at Devon, across the river from Fredericton. He is vice president.

Some time ago, when it was realized that the Staples "boys" had completed a period of over one hundred years of joint employment with the business, as its management had passed along down to the third generation, a banquet was held, with the two brothers as the guests of honor; all the employees were present, and cheered when the brothers were each presented with a check by the management, in recognition of their unparalleled record.

Both men of good habits, steady and reliable, the Messrs. Staples have lost but little time through illness, in the more than half a century they have each been with the industry; never, during all the years, has either one been known to be late in arriving for work; on the other hand, to this day, they are the first men on the job in the mornings.

Can you blame The Smith Foundry Company, Limited, for being proud of such a record?

E. B. FLEURY

(Continued from page 43)

Coast to Coast for many years, and has called upon practically every foundry in the country. He started as a moulder in his father's foundry when a boy of seventeen. Sensing the advantages to be gained from getting out among others of the trade, he left the family roof while in his early twenties to gain experience in other plants. In carrying out this set purpose he worked in Hamilton, Ontario, Rochester, N. Y.; Erie, Pa.; Cleveland, Ohio; Pullman, Ill.; Milwaukee Wis.; Grand Haven, Mich.; and Detroit, Mich. The experience he gained from such an itinerary proved invaluable to him in his later career as a foundry supply expert, enabling him to give to his customers a service which possibly no other man in the business could equal.

After returning to Canada, he joined the Hamilton Facing Mills Co., Ltd., as their representative, and was their sales manager until he severed his connection with the firm in 1912. In this year he opened the Canadian branch in Toronto of the E. J. Woodison Co., of Detroit, acting as the Canadian manager until the fall of 1914. With the opening of the war and the consequent depression of business he felt it advisable to launch into a strictly commission business, representing some of the largest manufacturers and producers of foundry requisites in Canada and the United States, having all goods shipped direct from the producer to the consumer. The results have been eminently satisfactory both to himself personally and to his numerous clients throughout the Province of Ontario which constitutes his field of operations.

It is probably unnecessary to state that Mr. Fleury has quite a fund of anecdotes and experiences covering his many years of connection with the foundry business which would fill many pages of this journal. His success is due entirely to the bringing of practical ideas and real, valuable service into the ordinary business of salesmanship and is a demonstration of the truth that service wins out.

Mr. Fleury's headquarters are in Toronto.

MOLDING SANDS

The Committee on Molding Sand Research under the guidance of Division of Engineering, National Research Council and American Foundrymen's Association, has made progress in its program of research. The U. S. Geological Survey and the various state geological surveys have promised to cooperate with the sub-committee dealing with this phase of the work under the chairmanship of Professor H. Ries, of Cornell University. This sub committee has prepared a letter of instructions to the state geological surveys, which will standardize methods of making the surveys of molding sand resources.

Work on standardization of tests is well under way. Questionaires have been sent out to gather information on the present methods of testing physical properties of sand. A digest of replies to these questionaires is expected to be available shortly.

Many firms and universities have offered to cooperate in the research work. Every endeavor will be made to maintain their interest and to assign problems to those universities and industrial laboratories offering to cooperate; due regard being given to the facilities and talent available. A list of research subjects has been compiled, which is given in part below.

1. Recovery of used molding sand through restoring bond to the sand by subjecting it to contact with water vapor under high pressure.
2. The effects of additions of certain chemical reagents upon the physical properties of clays and clayey materials, such as molding sand.
3. Effects of water content on the bond and permeability of a molding sand.
4. Effects of different water percents in molding sand on the milling and drilling speeds of light gray iron castings.
5. Research on fusion quality of facings (function of "peeler").
6. Tests of various kinds of clays for restoring bond to molding sand.
7. Comparison of lifes of different molding sands.
8. Effects on plasticity of bond in molding sand and reduction of water content when using oil.
9. Effects of wet and dry storing of sand on bonding quality.

Report of Sand Reclamation: The American Steel Foundries Co. has permitted a representative of the committee to make a digest of the sand reclamation work carried on by the engineering staff of the A. S. F. and has assisted in the preparation of this digest. Because of the scarcity of steel molding sand of the best quality and the problems arising from having to dispose of large quantities of refuse sand, this company has carried out an extensive investigation of methods of reclaiming the good material which is usually lost, whenever so-called refuse sand is thrown away. After experimenting along different lines and thoroughly going over methods employed in other plants, a process of reclaiming old sand called "centrifugal scrubbing" was developed.

After establishing the principle of this method, equipment was designed which permits a recovery of about 70% of refuse sand. Cost figures for 1921 show that a ton of reclaimed sand costs about $1 per ton against the cost of new sand at the plant, of $2.65 to $3.85 a ton. The process involves cleaning the sand grains of adhering fused material, then separating by air currents the good sand from the bad material. Included in the 30% loss is some good bonding material which, because of its similarity to bad material, cannot be economically separated.

Continuity of purpose establishes confidence. Confidence makes credit, capital and customers for any business man.

Development of the Metals After the Stone Age

The Axe is Taken as an Example to Show How the Early Copper and Bronze Tools Were Patterned After the Stone, and Later Improved Upon

By F. H. Bell

IN THE February issue of this publication we showed a flint arrow head and granite axe. These two stones were picked up right here in Canada but were, of course, not made by Canadians. Most antiquarians attribute them to the red Indian who inhabited the continent of America before the white man's appearance, but this is most assuredly a mistaken idea, as similar articles are picked up in every part of the world. In fact it is said of the blue stone, which I have referred to as granite, that there is not a quarry of such stone on this continent and that it must have been taken from one of the quarries in Asia where such stone is found.

From this it would seem that men traveled long distances in olden times

EARLY BRONZE

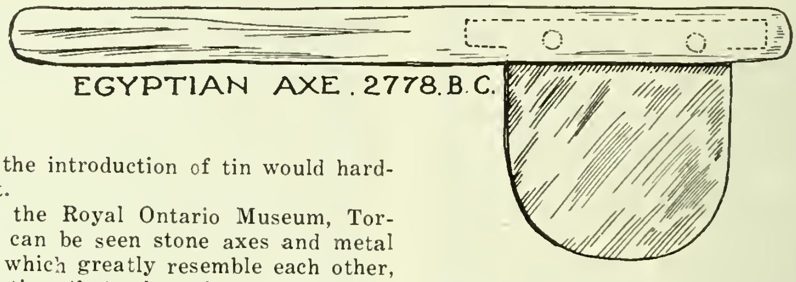
and that they had some way of getting from the continent of Asia to the continent of America.

However stone tools and weapons are not of particular interest to foundrymen, but their presence in every part of the world indicates that stone was universally used in place of metal which was evidently unknown to mankind at that time. The workmanship on the arrow head as well as the axe showed a high degree of skill, the arrow head being chipped into shape while the axe was ground by some means.

My object in illustrating these stone objects was to bring out what was undoubtedly the earliest work done in metal, and to prove as near as is humanly possible that copper was known and used before the advent of iron or steel.

Many modern writers attempt to show that iron was known at an equally early date but that it corroded into dust while the copper remained. This is most unlikely, for the reason that copper edge tools would not be made if a hard metal like steel was available.

The belief that the ancients had a means of hardening copper is also a myth, because there does not appear to be any of this hardened copper in existence at the present time. Copper in its pure state was, probably not used very long until the discovery was made



EGYPTIAN AXE . 2778.B.C.

that the introduction of tin would harden it.

At the Royal Ontario Museum, Toronto, can be seen stone axes and metal ones which greatly resemble each other, indicating that when the new material which we call by the name of copper came into use the same design which had been adopted for the stone axe was for some time adhered to for the copper ones.

Take for instance the one here shown as an early bronze specimen. This is not the very oldest one in the collection but it follows closely the design of the pure, soft copper ones which succeeded it and which were also shown, with slightly more rounding edge. Some of the copper ones were broad, much resembling the hand, meat chopping knife of the present day, but all, both copper and bronze were of simple design, just flat slabs drawn down to an edge, but with no provision whatever for a handle, any more than what was used for the stone axe.

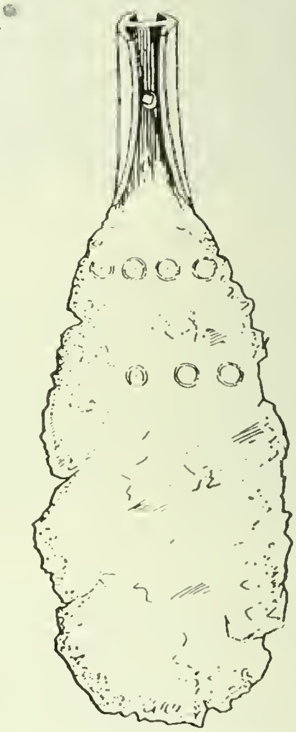
These axes would most probably date back pretty close to what might be considered pre-historic times and are not characteristic of any particular country. The handle would probably be split and bound onto the blade; the taper preventing it from slipping through.

In the next illustration is an Egyptian axe fitted to the handle. The handle, it might be explained is not the original one, but serves to show how the blade was most likely secured. Several of these blades are to be seen, some with two rivet holes and some with more, but all having the extended rib at the back. According to the Egyptian writing when translated into English the one shown was in existence 2,778 years before Christ. This, while being fairly old, must be considered as a somewhat modern one when compared with the former which must date back fully twice that far.

This Egyptian axe shows a fair degree of ingenuity while the former shows practically none. In the latter the idea of having the stiffener on the back is novel. It not only strengthens what is otherwise a delicate blade, but it provides a means of fastening it securely into the handle.

In the third view is an axe of Greek origin. This, while badly corroded and eaten away, is a decided improvement on either of the others. An arrangement for attaching the handle has been devised. At first glance it might be supposed that the handle would fit into the dove-tailed slot and that the axe would in reality be more like a cooper's adze, but on carefully investigating it the true usefulness of the arrangement can be seen. The handle did not fit into the axe any more than it did in the others. An opening of the exact shape would be made in the handle and carefully fitted to the axe with the blade running in line with the handle so that it could be used for chopping and splitting, and not for adzing. The peculiar shape, with the web up the middle would prevent it from turning, while the taper would keep it from slipping too far

(Continued on page 47)



ANCIENT GREEK

A Pioneer Foundry in Algoma District Canada

Construction Work on C. P. R. Makes Busy Times for Pt. Arthur —Late Premier Sir Oliver Mowat Sees First Iron Ore Melted in the District of Algoma

By JOHN WOODSIDE

THOSE of our readers who were with us two years ago will remember the interesting narrative by Mr. Woodside—how he blazed his way through the wilds of Montana, sometimes working at his trade, but more often picking up whatever he could get to do to keep his soul and body together and how he finally joined the American army and did his bit for the cause of civilization by assisting to quell an Indian rumpus. He is now contributing for the edificaton of his brother foundrymen a story of his return to Canada and his entry into business in what has, after nearly forty years of steady labor become one of the recognized industries of the flourishing city of Port Arthur —Editor.

Anchored at Last

It was during those pioneering days in Butte City, the flourishing mining camp of what was then Montana Territory, before the great mountain domain had attained to the dignity of statehood, that I began to receive letters from home urging me to return and join in a new foundry enterprise.

Canada had begun to wake up from her long period of lethargy, if not of sleep; immigration had begun to flow westward to the great plains; and across the Rocky Mountains, to the great western domain of British Columbia; first exploited for its golden treasure; now coming under the hand of the agriculturist, and the pressure had forced the government to open roads, trails of some sort westward to those great fields all ready for the plow; and for the domestic herds to replace the vanished buffalo.

When a company was formed to push that great enterprise, the Canadian Pacific R. R., from ocean to ocean, Prince Arthur's Landing, now Port Arthur, head of Lake Superior, and head of navigation on the great chain of lakes and rivers reaching from the Atlantic, sprang into prominence as a promising site for a great Canadian sea-port city. And here my home folks had gathered and settled during the early '70s, when the "Landing" was the centre of the silver mining excitement, and here I might incidentally remark that had the wonderfully rich veins of the district held out for depth like unto the veins of Montana and Nevada we would have had here one of the big mining camps of America. But unfortunately for the town and district, the mineral bearing rind of old Earth proved too thin at this particular locality; and although showing phenomenal riches from the very "grass roots," it soon "petered out" and mining for the precious metals, at least, has become almost a thing of the past. But at this juncture commerce had come to their rescue and the lake port cities began to boom with the railroad building, and the handling of supplies. So I was urged to return at once and take advantage of the opening afforded for a foundry and repair shop. We were not, however, the real pioneers in the foundry business in the cities, for during the early rush of the building of the Lake to Winnipeg section (a most important section of the C. P. R.) it was there the demand of the contractors for supplies and repairs urged the Smith Brothers of Fort William to open a small brass foundry which was soon enlarged to an iron foundry by the erection of a small cupola, the shell of which was formed from glycerine tanks, plenty of which stock was to be obtained around the new dynamite factory established near town. They also used the local sand for their work; but as the brothers were not practical foundrymen, but rather favored speculative house building, when the building boom struck the towns, which it did pretty hard, the little iron and brass works languished, and when we took up the work in more practical fashion at the Landing they let it die out altogether. Now, as we four brothers had learned different foundry trades, with a view to just such an opening, it did not take me long to decide, and the fall of 1882 saw me landed again in Canada. I spent part of the winter in the little pioneer shop in Tara which I had opened some years ago, now grown to a healthy agricultural shop, and the spring of 1883 saw me en route for the new bonanza town, with material for a snug foundry along with me on one of the old lake liners. One brother was already on the job, having, after much trouble and disappointment in the assistance at first offered by the town, obtained a site favorable as a business place, but as it has ever since proved, unsuitable for a foundry site, sadly lacking in drainage, as we were only a few inches above the lake level, in fact in past ages it must have formed part of the lake bed, for upon cutting through a foot or so, of muskeg we found the wave-washed sand bed, it necessitated thoroughly waterproof linings for pit and lathe and after years of painful experience I resolved that never again would I put a foundry floor on the top of a swamp; but time pressed, and railway contractors were clamorous for supplies, and repairs, and it at last transpired that the reeve, or mayor of the place had a lot for sale, centrally enough located, but it was this old swamp lot, so we had to accept the inevitable and get a hustle on or we would lose custom. And now came the question of a foundation. Cement, now so generally used, was not plentiful in the town, nor had the use become general, so it was decided to lay heavy timbers upon the sand bottom, and a raid was organized upon some large cedars adjacent to the town; the bush was not far away in those days, and as the father of the crowd was an old veteran of the broad axe, we soon had a broad cedar base laid to support our regular foundation timbers, or sills; those timbers were salvaged from the debris of one of the early quartz mills erected down on Current River during the early silver mining, but abandoned when the lode in the hills above it petered out. A quantity of those good pine timbers my brother, the millwright, and I rafted down the little river, and up the shore of the Bay, landing them close to the building site, after a rather fatiguing day on the water. We were now joined by a younger brother, the machinist, who brought with him a quantity of tools, and supplies for the new works, and the building grew apace. All was hurry, and impatience to see the machinery run; but there were many delays, scarcity of capital forced us to do most of the labor of building ourselves, when we might have been more profitably employed in fitting up the machinery; would-be customers were waiting, and getting impatient, for the word "wait" was not much in use during the construction of the C. P. R. We were a year, or more late for the western end of the road and now they were hustling along the eastern section down the ruffled shores of Lake Superior.

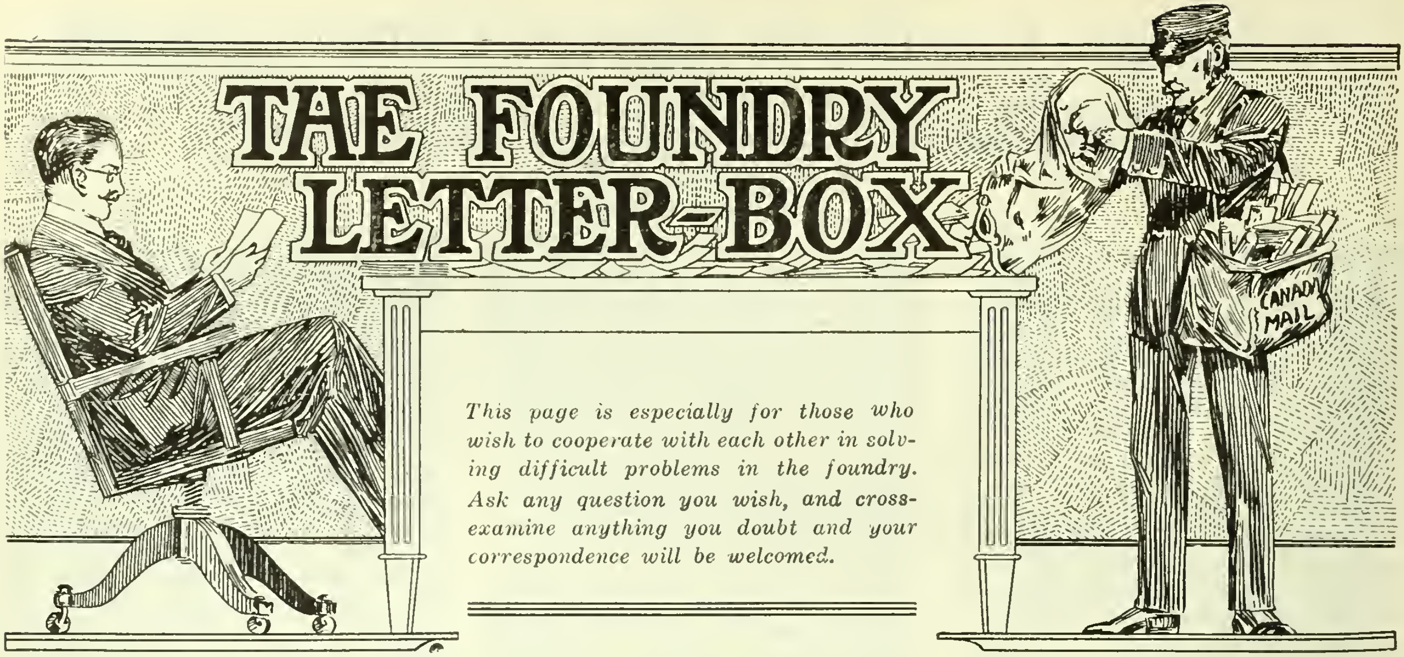
(To be continued.)

DEVELOPMENT OF THE METALS

(Continued from page 46)

through. The rivet which would go through the hole would not only assist in keeping the handle in place but would prevent the handle from splitting. This axe would, no doubt be considered a very perfect tool in its day, with nothing further to be desired. The little circles described on its surface are for no apparent purpose other than that of ornamentation.

In succeeding articles we will show how the axe was gradually improved by the people of Ireland, Cyprus, Peru and China, and how useful a museum is in showing the development from the past to the present.



THE FOUNDRY LETTER-BOX

This page is especially for those who wish to cooperate with each other in solving difficult problems in the foundry. Ask any question you wish, and cross-examine anything you doubt and your correspondence will be welcomed.

STILL HAS TROUBLE WITH TIN SCRAP

Editor, Canadian Foundryman:—In answering my questions regarding the use of tin plate scrap for making sash weights, in your last issue you give a very carefully prepared explanation, but I must say that I have melted the scrap in precisely the manner you describe and while it melted and ran out of the spout we could hardly get to the mold when it would be set in the ladle. There must be some way of delivering the metal in better condition than this.

Answer:—I will endeavor to go a little more into detail. In the first place it must be remembered that tin plate is simply sheet iron plated with tin, and sheet iron is just wrought iron rolled into sheets. Every foundryman knows that wrought iron cannot be melted and poured like cast iron unless it is very hot and then it runs sluggish. The tin which covers the plate has a hardening effect on the melted iron but does not in any way add to the trouble of pouring it, but rather assists it to flow. If this scrap is melted in a hot enough fire it will run into sash weights without difficulty. When melting tin plate scrap a good high bed of coke is required, and a sufficient pressure of blast to penetrate the extra high bed of coke. This coke bed when burned through should be at least twenty-four inches above the tuyeres. The first charge of scrap should not be more than three times the weight of the coke bed. Subsequent charges, if of loose scrap, should be in the proportion of four of scrap to one of coke. If the tin plate is pounded into bales it is possible to melt in the proportion of one to five, but no more than this. Baling the scrap is a simple process. A cast iron mold heavy enough to resist the jar and having a tapered chamber the shape of the bale is all that is required. The bale should be about a foot long and six inches square. The scrap can be pounded into this with a sledge or under a trip hammer.

As I have said, the metal being wrought iron will run sluggish, and can be improved by using some cast scrap such as old plow shares and grate bars. This kind of scrap along with the tin scrap will create an enormous amount of slag which must be fluxed and carried off. If sufficient fuel and blast is used it is quite possible to get rid of any old metal which is of no use for other work. Old eavestroughs and conductor pipes, second-handed cans, gas pipe, malleable iron or any other iron or steel can be utilized. It is very extravagant on fuel but it is a success and will turn out material which is ordinarily of little or no value into money, but the melting must be carefully watched—plenty of fuel and blast, and the furnace kept free from slag. It will take a little while to get every detail mastered but it can be done.

WANTS MIXTURE FOR PISTON RINGS

Editor, Canadian Foundryman:—Can you give me the analysis for a good metal from which to make piston rings. I want a metal which will be quite springy and, of course, perfectly sound. I think the same iron should do for the pistons and the cylinders as well as the rings.

Answer:—If you understand the semi-steel process, it is certainly best to mix in about ten per cent. of steel for this kind of work. Sufficient fuel must be used to bring metal down white hot. What you require is a close grained metal, free from sulphur cavities or dross of any kind. If you do not mix in any steel there is nothing better than pure stove-plate. Pick out all the burned parts but leave the bolts, as they do no harm. If you melt at a high enough temperature the bolts will melt and run in with the rest and improve it. The secret of good sound castings is to have the metal hot enough so that it will throw off all impurities. Stove-plate is made from good stock and melts easily. In fact it has all the requirements for good work such as you are asking about but it has one drawback in that it burns away in melting to a much greater extent than heavy iron and as a consequence is more expensive than other iron unless bought at a correspondingly lower price. Stove plate is quite frequently condemned on the ground that it is burned and will make hard castings. Where such an argument comes from is a mystery as there is only a very small part of the stove which is burned, and this must not be used in good work. As a matter of fact stove castings are no different from any other castings made from the same kind of iron, but the fact that it was run into such thin section and still remains gray is evidence that it was good metal, and having as a necessity been poured fairly hot it will be clean. Re-melting it makes it just right for cylinder and piston work.

RANGE TOPS TURN RED

As a subscriber to your interesting publication, we would greatly appreciate any information you could give us regarding methods used by certain range manufacturers in the treatment of polished grey iron range tops, to prevent them from rusting, and more especially to prevent them from discoloring or rather taking brownish and reddish colors after excessive heating.

We understand that some range manufacturers produced some range tops of polished iron color not altered when cool after excessive heating of the range.

We are told that some foundries use alloys in the ladle to produce special iron to cast those range tops, but we are rather inclined to believe that this is not generally done.

We are also aware of some treatment for bluing grey iron range tops and would also be pleased to get information regarding the best practical methods, and if they are in use in some Canadian stove manufactories. We would further appreciate any information regarding any treatment of range tops in use by range manufacturers.

Answer:—There are alloys which will prevent oxygen from attacking the iron but it has not yet been perfected to an extent which would permit of its being used in range castings. Anything which is put in the ladle is for purifying purposes but not for the purpose of preventing corrossion. The coloring which you refer to is more of an enamel, and prevents the oxygen from coming in contact with the iron. There are some of these enamels which are good imitations of bare iron while others are intentionally made blue.

Unless some airtight covering keeps the iron from oxidizing there is no known method of preventing it from turning red. Iron and oxygen have a strong affinity for each other and form oxide of iron which is always red. Red clay and red sand get their coloring from the presence of iron. Blood is red from this same cause. Tincture of iron such as is used in medicine is red, so it will be seen that wherever iron is, it will be red unless kept from the influence of oxygen. Newly made castings, unless left to cool in the mold will be red when cold. Graphite blackening has always been used for the purpose of keeping the stove from tarnishing, but it could not prevent the metal from turning red after being excessively heated. The fancy enamels of different colors are only fads which will soon pass away. So far I am not aware of any Canadian concern which has adopted the enamel idea. It would, however, not be on the lids, and these are the parts which are most likely to become overheated and remain red.

GRINDING ALUMINUM CASTINGS

Editor, Plating and Polishing Dept.—Could you give us any information on the subject of grinding aluminum castings? We have a special job on hand which does not require fine finish (No. 2 sand paper is plenty fine enough) but the castings which are of irregular shape require to be accurate and the lines run true. We have tried putting loose grains of aloxite and carborundum, on a canvas-covered, soft-padded or cushion wheel, but have had difficulty in making this grit stick to the canvas. We would be very glad for any information you could furnish us on this subject.

Answer:—Aluminum is not nice material to grind, for the reason that it gums up the wheel. To overcome this you should oil the cutting face of the wheel with machine oil or preferably with tallow. This does not prevent it from cutting but it prevents the aluminum from filling up the wheel. No. 120 Turkish emery is customary for such work but the material which you are using should not make the trouble that you are having. When preparing your wheel, have the emery or carborundum spread out on a flat surface. After coating the face of the wheel, do not lose any time, allowing the glue to partly set, but as soon as the glue is on, roll the wheel in the abrasive which was previously spread out. If allowed to become thoroughly dry it should hold on until worn off from constant use. This should not be rapid if the cutting face is kept well oiled.

A RECORD CASTING

The largest iron casting ever made in Great Britain and one of the largest ever produced in any country was recently turned out in a British factory. It weighed 110 tons and the mould was built in a 16 foot pit. Seven hours were occupied in melting the metal, and the casting was poured in just under five minutes. Three weeks were occupied in cooling the casting. Owing to its enormous size and weight the casting had to be delivered by road, six traction engines being used for hauling it.

BLOW TORCH OPERATES UNDER 10 FT. OF WATER

Interesting experiments have been carried out in connection with the operation of the oxy-acetylene torch under water. One of these was made recently in England, the diver working inside a huge circular tank filled with water. The tank is fitted with several plate-glass windows, which allow close examination of what is going on inside, the tank itself being internally illuminated. Equipped with a diving suit, complete with telephone apparatus, the diver could be heard acknowledging instructions that the oxy-acetylene apparatus was about to be lowered to him. From above several attendants worked the diving apparatus and the above-water end of the telephone, while a mechanic lit the oxy-acetylene flame from an ordinary candle. This submersible flame burned with an increasing roar as more power was turned on, the roar abruptly ceasing as the apparatus dipped below the surface to the waiting diver, who proceeded to demonstrate the possibilities of this new process, neatly applying the flame to a sheet of steel which reposed on two iron trestles. From the observation windows the illusion that the diver was doing salvage work on a sunken ship was heightened by his apparently awkward movements in the green cloudy water. The impression was left that this new invention will have a great future in salvage work on vessels sunk during the war which cannot be raised intact owing to present prohibitive costs.

MONEL METAL FOR VALVES

Monel metal resists the eroding and corroding effects of hot steam, has a comparatively low co-efficient of expansion, and one which agrees very closely with that of cast steel. These three qualities make it particularly suitable for the seats, discs or other wearing parts of high duty valves. The non-corrodible feature causes resistance to superheated steam, the expansion similar to steel keeps the seats in the same relation to the steel bodies usually used for these valves, and the comparatively low expansion brings about retention of size and shape at all times. For this reason it is widely used, and a majority of the higher class high duty valves are trimmed with monel.

PATTERNMAKER'S LATHE

There has recently been placed on the market a motor driven patternmaker's lathe built in sizes of 16, 20, or 24 in. swing. The lathes are supplied in standard bed lengths of eight and ten feet. A somewhat unusual feature is one that permits the headstock to be swung about five degrees each side of the centre to provide for turning tapers. For the accommodation of face plates the spindle is threaded on the outer end as well as on the inner and usual place. Radial loads and the end thrust of the spindle are taken by double-row self-aligning ball bearings. The open side type of tailstock is provided. For turning tapers the tailstock may also be set over. A compound rest is provided with complete graduations, which permits quick settings to be made at various angles. Power feed is regularly furnished to the carriage and in addition a hand feed can also be provided. Where power feed is provided it is controlled by a friction knob on the apron, and reverse can be obtained by operating a lever. A two horsepower motor, mounted on an adjustable base and direct connected to a four-step cone pulley, is located on the under side of the bed directly under the head. The adjustable feature of the bed allows for belt adjustment. Belt shifters and a control box are conveniently located. A brake lever, operating on the inside of the cone pulley on the spindle instantly stops the rotation of the spindle when the power is shut off. If desired the machine may be equipped with a countershaft drive. The manufacturers are The Imperial Metal Products Co., of Grand Rapids, Mich.

Metropolitan Motors Limited, is a new industry recently opened at 22-26 Temperance St., Toronto, to do mechanical electro plating and polishing in nickel, copper, silver, gold, brass, bronze, and lead. By mechanical plating is meant work which is done in revolving plating and burnishing machines, where the individual parts are not handled separately. The most modern equipment is installed throughout the entire plant and the company reports that they are already enjoying a good run of business which is steadily increasing. Lead plating which is included in their list is a comparatively new and little known process, but it has its usefulness in battery hardware and other metal parts exposed to acid fumes, also on ship hardware.

F. H. BELL, Editor

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Technical Journal Devoted to the Foundry and Metal Industries.

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THE MACLEAN PUBLISHING CO., LIMITED, 143-153 UNIVERSITY AVE., TORONTO, CANADA

The Foundrymens' Convention

PRACTICALLY everything is ready now for the twenty-sixth convention and the sixteenth exhibition of foundry equipment in connection with the American Foundrymens' Association. Since there was no convention last year the coming one should be well patronized. A convention is something which should be looked forward to with interest as it combines a lot of different features which it would be hard to get in combination by any other means. It affords an opportunity to inspect all the very latest devices in foundry equipment; it gives the foundrymen from all parts of the country a chance to get together and discuss the best methods to be adopted in the various performances of foundry work while following up the reading of papers by the world's most famous foundrymen, and it furnishes the overworked business man or executive with an outing which acts like a tonic to him that is cooped up in his none too invigorating quarters in his foundry or foundry office.

Rochester, N.Y., where the convention is to be held is particularly well favored in regard to location and surroundings. Situated as it is amidst flower gardens, orchards and nurseries which will be in full bloom at the time of the convention, it affords lovers of the beautiful a pleasing relaxation from the steady grind of business. Being a lake port it affords a line of pleasure not to be had in inland locations—that of boat riding.

While the convention is managed by the American Foundrymens' Association, the entertainment and amusement features are being attended to by a local committee, the members of which are going the limit in providing a program which will cover the entire ground.

If Canadian Foundryman can be of any assistance to those contemplating attending we will be only too glad to be communicated with. At the convention our headquarters will be in building No. 3 and booth No. 338 right near the registration booth. Don't hesitate to come right in and call No. 338 your booth. While we have no personal interest in the convention we know from experience that attendance at a convention is time and money well spent, and we would strongly advise all who can spare the time to attend. For those who cannot possibly be there we might say that we will endeavor to report accurately what transpires. Our next issue will be our Convention Number, and will contain a full report of the convention. It will not be possible to describe in detail everything in one issue, but in our Convention Number we will particularly stress what is doing in the molding machine field. The molding machine is now, more than at eration, and for this reason we will bring out what improve- any time in its history, a dominating feature in foundry op- ments have taken place in this direction during the last couple of years.

Since the question of aluminum is to hold an exceptionally prominent place in this convention we will feature aluminum in our July number. In succeeding numbers we will endeavor to publish what is really of value from the convention.

Conditions Greatly Improved

AS PREDICTED a short time ago, if we could get past May day without strife between employer and employee we would be due for a long spell of prosperity. This prediction is now materializing. While there is no boom there is a decided improvement in conditions during the last few months. Foundries which have been closed up tight for more than a year, and others which have been operated spasmodically are now running to full capacity. There are some, particularly those in the farm implement lines who are overstocked and can not possibly operate to capacity until after harvest.

These shops are running in a moderately fair way, but if the farmers have a good crop which, to all appearances they will have, these goods will be disposed of and the shops will operate to their old time usual capacity. The lines which seem to be the busiest are those directly connected with the automobile industry. It is not beyond the truth to say that there are more automobiles being turned out, both in the United States and Canada this year than at any time in the history of the industry. One concern alone shipped sixty-two freight cars, each containing five automobiles, in one day, to the sea board for export.

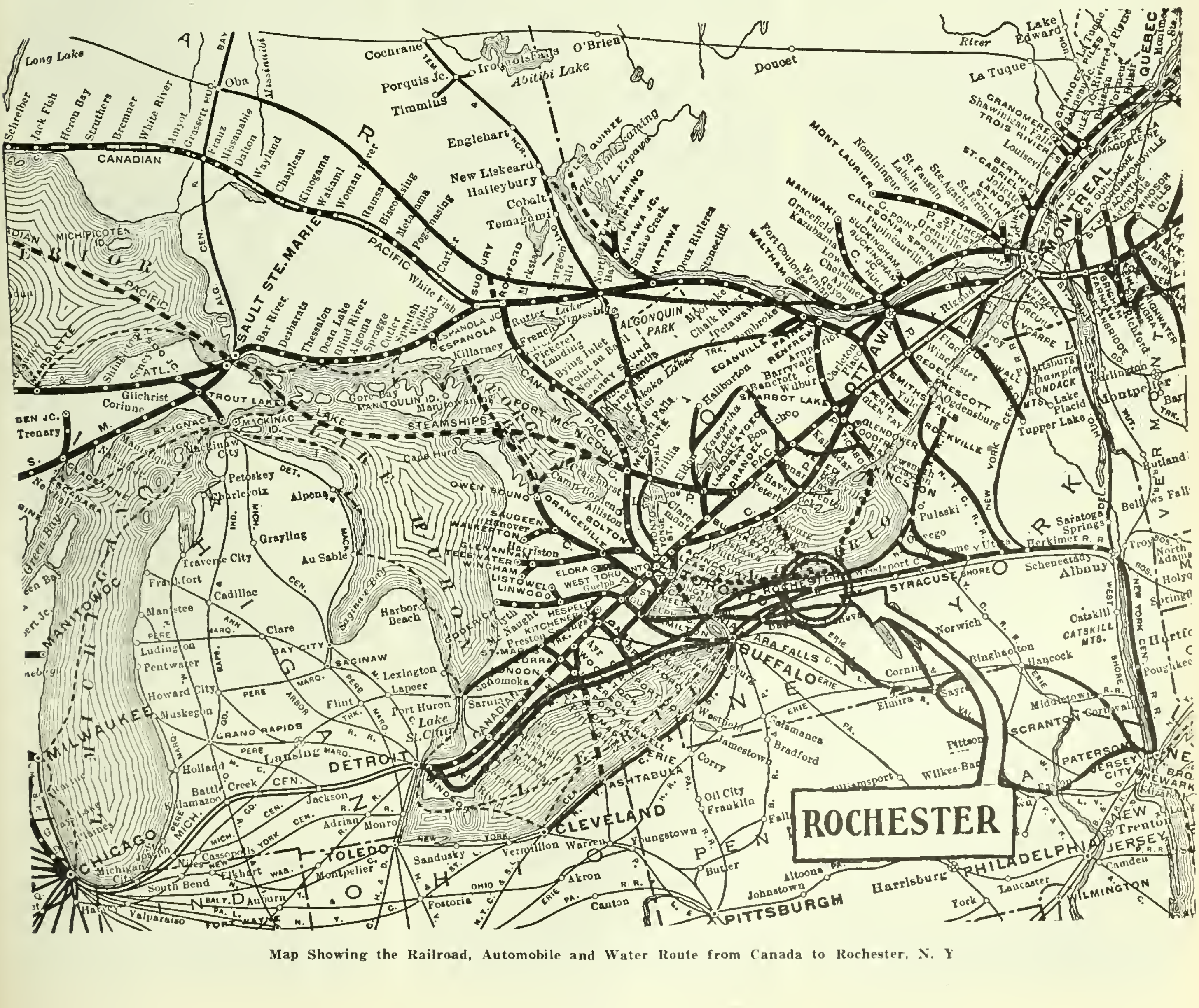
The only drawback to be overcome now in order to have continued prosperity is that of fear. The employer is perhaps sincere in his fears on account of the prolonged panic which he has just passed through, and he may also be encouraging the idea in order to prevent trouble with his men, but there seems to be a universal fear among both employer and employee that the present prosperity may not last, but this fear is groundless. Some very large contracts have been let, and while the manufacturers are not telling all they know, they are buying in a manner, much different from what they had been previously doing. Those who were buying fire bricks in lots of one hundred to patch the cupola lining are now buying in car-load lots. All the supply houses are feeling the good effects of the present revival of prosperity. There is no boom but the panic has spent itself and business will continue to improve from month to month.

A Sensible Idea

FOR SOME reason the foundry business has been lagging behind others in regaining normalcy, with the result that molders have been employed three or four days per week and in many cases let out for weeks at a time.. In contrasts to these conditions in the foundry, the building trades never were busier. Brick yards as well as wood-working factories making building supply lines are working to capacity. Some molders who have homes to provide for and who require all the ready cash they can acquire have figured that, so long as they are not crowding any one else out of his rightful position, they can do better, by working at such lines as will give them steady employment. The rate of pay is not much different, and a steady job, in a factory at helper's wages, yields a bigger pay envelope than short time in the foundry at molders' pay. The change of occupation for a short spell is good for the health, while making steadier work for those who remain in the foundry. There would not be much unemployment if every workingman would strive to get employment where help is required instead of hanging on for one job only.

Market Quotations

CONDITIONS in the metal marker are still far from brisk although prices hold firm. The strike of the coal miners has had the effect of raising the price a couple of dollars on pig iron. Prices this week f.o.b. Toronto, are quoted as follows: No. 1 pig iron, $29.15 per ton; foundry coke, $15.50 per ton; copper, $17.00 per cwt.; tin, $35.50; zinc, $7.25; lead, $6.75; antimony, $6.75; aluminum, $26.00. Prices on scrap metal are uncertain. The following prices are being paid by dealers and sold at whatever advance the demand will merit. Copper, from $8.00 to $10.50, according to weight. Machinery brass, $8.50; brass turnings, $6.00 for red and $4.50 for yellow; zinc, $4.00; heavy lead, $4.00; tea lead, $3.00; aluminum, $10.00; heavy melting steel, $10.00 per ton; malleable scrap, $11.00; No. 1 machinery cast iron, $16.00; car wheels, $16.00; stove plate, $14.00; cast borings, $5.00.



Map Showing the Railroad, Automobile and Water Route from Canada to Rochester, N. Y

The Steel Trough and Machine Co. Tweed, Ont., have opened an office in Montreal to take care of their Quebec business, under the management of R. L. Welsh. Their Montreal office will be Room 216, St. Nicholas Building.

* * * *

New Foundry for Halifax, N. S. Work has begun on the new foundry building for Hillis and Son of Halifax by the contractors, the Nova Scotia Construction Co. The building will be of brick and concrete and will be fireproof throughout. The plans were prepared by Lockwood, Greene and Co., Montreal. The cost of the structure will be $50,000.

* * * *

A silver mine has been located at Vernon's Island, Palencia Bay, Newfoundland. W. H. McKay, mining expert, who has arrived at St. John's with samples of ore, showing not only silver but iron and lead, thinks there are evidences of another Cobalt in that district. A contract has been entered into for shaft sinking and other preliminaries to mining.

* * * *

Advices from Point Edward, the distributing point of iron ore, state that a distinct revival in the ore industry can be looked forward to. Many boats are being chartered. Last year but 3,000,000 tons of ore were transported down the lakes, as compared with 56,000,000 the previous year. The record of two years ago is expected to be equalled this year.

* * * *

The Canada Iron Foundries of Montreal, have obtained a contract for 10,000 feet of class "C" six inch cast iron pipe at $68.00 per ton for the city council of Edmonton. The council has also awarded contract for lead pipe at $10.50 per 100 pounds, to the Metals Limited of Edmonton. These figures are f.o.b. Edmonton.

* * * *

The directors of the Cockshutt Plow Co., Brantford, Ont., at a meeting called on account of the death of their late president and general manager, Mr. George Wedlake, appointed Mr. E. Mott to the position of general manager, while Lieutenant Governor Harry Cockshutt was re-appointed to the presidency, which position he held prior to his appointment at the head of the Legislature. G. K. Wedlake, son of the late president, was appointed as shop manager, a position for which he is eminently qualified on account of his many years of training under his father's supervision.

J. W. Paxson Co., Philadephia, are distributing an interesting pamphlet describing the various lines which they manufacture. Their foundry lines include cupolas, furnaces, ovens, ladles, linings, pan grinders, sand blast, magnetic separators, tumbling mills, and in fact practically everything in the way of foundry equipment.

* * * *

The Independent Pneumatic Tool Co. announce that they will have an exhibit of Thor pneumatic and electric tools at the Rochester Convention. They will be represented by R. T. Scott, vice president, H. G. Keller, F. H. Charbone, F. J. Passino, S. W. Lanham, H. F. White and Adolph White. Their location will be at booths 137 and 139.

* * * *

The Wettlaufer Co., machinery manufacturers, have started building operations on a site in the lower Kingston harbor, in accordance with their agreement with the corporation of the city of Kingston. Particulars as to general details of the building have not yet been issued. The work is at present under the charge of J. W. Lytton, contractor, of Kingston.

* * * *

The copper output last year in British Columbia was about 39,037,000 pounds, which was nearly 6,000,000 pounds less than in 1920. The corresponding values were $4,879,624 for 1921 and $7,832,899 for 1920. The production of lead amounted to 41,402,288 pounds, an increase in volume of 2,071,070 pounds. Zinc produced was nearly 50,000,000, valued at about $2,000,000.

* * * *

The H. M. Lane Company of Detroit and Windsor announce that they will, as usual, have a booth at the Rochester Convention, showing views of their work, that of designing and engineering the construction of industrial plants. They will be represented by Mr. H. M. Lane, president, Mr. A. C. Thomas, secretary and treasurer; and Mr. G. Pitt who has charge of the architectural work.

* * * *

The Toronto Furnace Co., formerly the Toronto Furnace and Crematory Co. 111 King St. East, have dropped the crematory department of their business and have moved their head office to 35 Golden Avenue, where they have an up-to-date foundry. In addition to manufacturing a full line of hot and warm air furnaces they will do general jobbing in heavy and light machinery castings for which they are fully equipped.

Sarnia, Ont.—The ratepayers in Sarnia have voted a special assessment of $300,000 for the Dominion Alloy Steel Corporation, also a by-law for expenditure of $40,000 on improvements to present fire department. Officials of the Steel Corporation say that the first sod of the new factory will likely be turned sometime in June. The plant will occupy about 400 acres.

* * * *

The Auto Specialty Company, Windsor, Ont., who operate a large malleable iron foundry in that city find business away beyond their capacity. They have the foundation built and are asking quotations on material for an addition which will double their present floor space. This foundry was built two years ago, and has been busy right through the depression. It is the intention to proceed at once with the construction of the new buildings.

* * * *

Canadian Aluminum and Brass Co., is a new corporation recently organized at Windsor, Ont. Their foundry is at the corner of Windsor Avenue and Hanna Street in that city. They have an installation of four oil-burning, tilting crucible furnaces manufactured by the Belleview Industrial Furnace Company of Detroit. They have been in operation since the first of April and are already enjoying a satisfactory volume of business. Mr. J. P. Carritte is president of the company.

* * * *

Among the manufacturing concerns who will be represented at the Rochester convention will be the Hoevel Manufacturing Corporation, 154 Ogden Avenue, Jersey City, who will exhibit dustless self-contained automatic sandblast machines, comprising an 88 table machine, 32/40 barrel machine in operation, Hoevel sandblast tanks, injector, Triplex Injector sandblasts. They will be represented by J. M. Betton, L. B. Passmore and F. Welte.

* * * *

Wettlaufer Brothers, Limited, head office 178-180 Spadina Avenue, Toronto, with plants in different parts of Canada, have just completed a new and strictly modern foundry at Mitchell, Ont., to replace the one which they had outgrown. They manufacture a full line of builders' and contractors' machinery and equipment, specializing in concrete mixers and equipment for the production of concrete bricks, blocks, drain tile and sewer pipe. They find business exceptionally good, and report that they are planning some of the largest contracts in their history during the present season. The new building will add 12,000 square feet of floor space to their plant. They are contemplating additional machinery but have not decided as yet just what is will be.

* * * *

The Dominion Motor Casting Co., Windsor, Ont., after having been closed down for more than a year have reopened and are running full blast. They have work booked for four months' operation and have every confidence that business will be brisk for the balance of the year. As a line of their own they are manufacturing electric washing machines and wringers. In addition to this they are doing the transformer work for the Moloney Electric Company of Canada.

* * * *

Dunnville, Ont.—Contracts for the new waterworks have now been awarded. Following are the firms who have secured work on this project. The Canadian Engineering & Contracting Co. of Hamilton will build the sedimentation basin, 25x60 feet, also the filter. The Arthur S. Leitch Co., Toronto, has the contract to supply the Roberts filter equipment. The Turbine Equipment Co. Toronto, will supply the pumping equipment, and when completed, the system will have a 40-horsepower service pump, pumping 750 gallons a minute.

* * * *

Business Brisk in Woodstock, Ont. The four foundries which constitute the iron working industry of this city are all busy. T. Watson, manufacturer of tile machinery and other cement and concrete mixing equipment is rushed with orders. The Eureka Planter Co. who built their foundry three years ago with floor space for four molders, have since enlarged to an extent which permits them to employ seventeen moulders, all of whom are working full time on ordered work. The James Stewart Manufacturing Company are running their entire staff of men full time, principally on their warm air furnaces. The R. Whitelaw Engine Works is also running steady with the regular staff of men.

* * * *

Queen City Brass Foundry, 28 Dalhousie St., Toronto, are very busy, regardless of the depression which has been hovering over the land for so long a time. They do job work entirely but have a regular run of steady customers which enables them to keep their entire staff working full time. Their strongest feature, however, is that both Mr. Lennon and Mr. Grigg, the partners who own the business are practical men, and while they do not exactly do the actual molding themselves, they find occupation in the shop and are kept busy all the time. These lines include red brass fittings for hot water boilers, yellow brass castings for different purposes, bronze for first class machinery work and aluminum castings for vacuum cleaners and other lines calling for aluminum work.

Goldstein Manufacturing Co., Toronto, are now located in their new building on Beverley Street. They will specialize in the manufacture of copper and brass tubing, likewise seamless rods.

* * * *

Crowe's Iron Works, Guelph, Ont, was badly damaged by fire a short time ago, when one section of the main foundry building was completely wrecked. No serious delay will be caused, however, in the company's ability to deliver goods. Rebuilding the damaged part is already practically completed.

* * * *

The Dominion Wheel and Foundries Co., 131 Eastern Avenue, Toronto, report that they sold more car wheels during the first three months of the present year than during the entire year 1921. They also delivered some fairly large castings from their jobbing department, so that on the whole they have no complaints to make regarding business and prospects for this year.

* * * *

The Sherbrooke Machinery Company, Sherbrooke, Quebec, are distributing pamphlets treating on their rotary positive pressure blowers and their cydoidal vacuum pumps. The contents include other articles which they manufacture, but the descriptive material relating to their foundry blower shows the interior of the machine which is very simple in all its details. All the bearings have ring oiling arrangement. Tables are shown giving size of blower from No. ¼ with a capacity of ¾ feet per revolution up to No. 8 with capacity of 112 feet per revolution. Also valuable information on sizes of cupola from 11 inches up to 96 inches, with size of blower and number of revolutions required for each size of cupola.

* * * *

The Penton Publishing Company, Cleveland, Ohio, have just taken from the press their latest book, entitled, "Foundrymen's Handbook," 309 pages, 6 x 9 inches, price $5.00.

The foundry's famous "Data Sheets" have been compiled and put into book form with much additional information—thus furnishing foundrymen with a reference work by the use of which they can successfully solve any ordinary problem arising in foundry operations. It is a complete compendium and handbook covering every branch of foundry work from estimating the price to cleaning the finished casting.

For instance, Section II, contains the formulas for computing the weights of castings of all shapes and sizes in any kind of metal; Section IV, gives the compositions and physical properties of every known nonferrous mixture, data on fluxes, deoxidizers, pickling solutions, melting points, strengths of metals and alloys with the effect of different brass additions, and suggests to the brass foundryman the proper choice of metal for given requirements.

Section V, gives the standard specifications for gray iron castings, cast iron pipe, cylinders, special castings, scrap metals, case hardening and annealing; Section VI, gives miscellaneous tables for every-day use in the foundry, such as gross and net ton equivalents, tables for conversion of weights and measures from U. S. to metric system and vice versa, etc, etc.

Every table or formula you are ever likely to use in foundry work is here in this book—the first time they have ever been gathered together in one volume.

"Foundrymen's Handbook" contains exactly the information needed by the foundryman, the patternmaker, the metallurgist and student. It is indexed so completely that whatever you are looking for can be instantly found.

* * * *

A REMOTE IRON FOUNDRY

The island of South Georgia, where Sir Ernest Shackleton has been buried, is 2,000 miles from civilization; but it is shortly to possess a complete, though small iron foundry. A British firm has despatched to this distant isle one of its special comprehensive plants for making castings required in repairing the machinery of whaling vessels. Any necessary repairs to the ships can also be carried out by this equipment.

PUBLIC HEALTH SERVICE SHOULD BE ENCOURAGED

In order to save the workingmen from ill health resulting from insanitary working conditions and to save manufacturers from incurring claims from damages it is necessary for the Public Health Service to examine physically both the workmen and the plant in which they work. Some manufacturers and many workmen fear examination, believing that it will be used to make trouble for them, and not realizing that undiscovered defects in either plant or man will surely lead to serious reults. To such the Public Health Service says that it is strictly neutral and that it will not "tell tales." Its object is to improve the health of the men and to enable the factory to save money by making its employes healthy by giving them healthy working conditions.

CONVENTION NOTICE

Those who contemplate attending the Foundrymen's Convention at Rochester on June 5th would save a lot of anxiety by corresponding with Mr. C. E. Hoyt, secretary of the association, 140 South Dearborn St., Chicago, and secure an identification certificate so that there will not be any difficulty in securing reduced rates on the railroad.

CHINESE WEIGHTS AND MEASURES

1 Catty=1 1/3 lbs. or 604.53 Grammes

1 Picul=133 1/3 lbs. or 60.453 Kilogrammes.

I Mow=1/6 of an English acre.

1 Li=2,115 feet or 2/5 of an English mile. It is usually spoken of as 1/3 of an English mile.

PLATING AND POLISHING DEPARTMENT

Question.—As a subscriber to your valuable paper may we ask for the following information:

We are preparing to install a new nickel bath in our plating room. The tank dimensions are: length, 72 inches; width, 36 inches; depth, 24 inches. We would like to know, first, how many pounds of nickel anodes, 8 in. by 20 in., it will take to equip the tank to produce nickel deposits of good quality? About how many anodes would be required? We have a dynamo of 125 ampere capacity. Will this be too small? What kind of dynamo should we have, and what ampere capacity would be advisable?

We would add that the goods to be nickeled consist of cast iron stove plate. May we also ask where we can procure a book describing all operations of polishing and plating?

Answer.—You do not state whether you intend operating the nickel tank with two or three rods of anodes. We would judge from the nature of your product and the width of the new tank that you will use the tank with five rods, two for castings to be nickeled and three for anodes. If you operate with three rows of anodes you will require 25 anodes 8 in. by 20 in. Hang 8 anodes on each outside rod and 9 anodes on center rod, the reason for using the extra anode on center rod is that the center anodes plate both ways and it is good practice to hang as many anodes on the center rod as possible. It is false economy to equip a nickel plating tank with small anode surface. Also remember that but one side or about one-half the surface of the anodes on outside rods is really effective anode surface. On center rod you have 8"x20"x2x9=20 sq. ft. plus 2 sq. ft. as edges when newly equipped. On each side rod the anode surface would be 8"x20"x8=approx. 9 sq. ft. plus 1.7 sq. foot as edges, therefore on the two side rods you would have a total of approximately 21.4 sq. feet of effective anode surface, while on the center rod the total effective anode surface would be 22 sq. feet. Now, in calculating the anode requirements for a nickel plating tank of any dimension we do not take into consideration the weight of the anodes unless we wish to figure costs. The weight of the anode is not an important factor in the actual efficiency of the anode while in use as a source of metal for plating. The effective surface area is the all important point, the larger the effective surface area of the anode, the more economical to operate. With small anode surfaces the capacity of the tank is reduced. Why operate a 200-gallon solution with small anode surface and process only one-half or three-fourths the quantity of goods in a given time that would be possible with large anode surface? Your tank will permit a working volume of 210 to 215 imperial gallons of nickel solution and figuring 6 gallons of solution to 1 sq. foot of cathode surface you should be able to process 35 sq. feet cathode surface per load with three rods of anodes. We have found the total effective anode surface (3 rows)to be 21.7+22 sq. ft. or 43.7 square feet, and with 35 square feet of cathode surface you will have an anode surface of over 8 square ft. in excess of your cathode surface. This condition is theoretically and practically correct.

Nickel anodes 8 in. by 20 in. weigh approximately 28 pounds each. If you use three anode rods or a total of 25 anodes your anode requirements by weight would be 700 pounds. By maintaining a large anode surface you decrease the amount of nickel salts necessary to keep the metallic strength of the bath constant and uniform. The anode even at present prices is the cheapest source of metal supply for a nickel bath.

As regards the 125-amphere dynamo, it would be too small to operate this new tank with three rods of anodes, as you will see by the following: An ordinary double sulphate nickel solution will allow at least 4 amperes per square foot to be used on cast iron, 35x4=140 amperes. By using a more concentrated solu ion, one prepared by adding nickel sulphate and boric acid you could easily operate the tank of solution with a current of from 280 to 300 amperes per load and finish the batch in less time. We prefer the compound wound dynamo for stove plating. The compound wound machine is less liable to cause trouble where inexperienced help is employed. In selecting a machine, get one of recent manufacture as some compound wound machines of early design proved very troublesome because of their liability to generate a reverse current. We would not advise a dynamo of less than 250 amperes capacity at 5 volts. If you have any indication of increased output for the future we would strongly advise a 500-ampere machine, compound wound, multipolar, 5 or 6 volts. The difference in cost of the 250-ampere machine and the 500-ampere machine will cost less than one hundred dollars and you have the advantage of the extra power in case of emergency. We will be pleased to advise you regarding the selection of a reliable machine if you wish to refer the matter to us. If you decide to equip the new nickel tank with less anodes than we recommend and process smaller loads per batch, you may be able to make the 125-ampere dynamo answer your purpose for the present. There is no book published which covers the entire field of polishing and plating as practised today. The best book, in our opinion, is "Polishing and Plating," written by Herbert J. Hawkins, published by Hazlitt and Walker, Chicago, Illinois, U. S. A. Price $2.00. The methods described in most books with reference to plating are more or less antiquated. Practical plating as now carried on in the industries is the result of skill and studious research and experiments on the part of progressive electro-platers and electro-chemists during the past ten years. The columns of the CANADIAN FOUNDRYMAN are at your service when you require information relative to the casting or finishing of metals.

Question.—I have charge of the plating department in a factory producing large quantities of steel nuts, bolts, screws and threaded bars. These pieces are hardened and when received in the plating room the threads are very badly filled with a hard substance which I am told is burnt cyanide. Ordinary methods of cleaning do not affect this substance, and if the parts are plated without removing the hard substance the nickel forms over it to a certain extent and produces a condition which renders the assembling of these threaded parts practically impossible. I have heretofore removed the bulk of this scale or burnt cyanide by pickling and brushing with wire brush, but scarcity of labor and high price of acid has caused the firm to interest themselves and they have requested me to write you explaining the trouble and solicit your advice regarding steps to overcome the present conditions.

Answer.—Your firm have evidently made a mistake common to most concerns engaged in electroplating their manufactured product: Blamed the plater for results he should not be held responsible for. You admit that the source of your trouble is in the heat treatment. Then a very logical thing to do would be to correct the methods of heat treatment with respect to such threaded pieces as cause trouble. We infer that your method of hardening these nuts, bolts, etc., is by application of cyanide to the hot metal while in a furnace, and with a very disastrous effect on the furnace lining. To produce a clean thread by cyanide hardening, procure a cast iron pot of dimensions suitable to facilitate handling a reasonable quantity at one time. Place the iron pot over an enclosed fire, either oil, gas or coal will answer. To treat the threaded pieces, melt sufficient cyanide to allow complete immersion of an iron basket of suitable size. Immerse the pieces contained in the iron basket and allow them to remain in the molten mass for approximately 10 minutes. Remove, shake vigorously and dump the contents of basket into clean, cold, running water. The result will be a clean thread, and satisfactorily hardened metal, less work in polishing


DIRECT FROM MANUFACTURER TO CONSUMER
Can. Mach.

department, and freedom from useless labor and worry in plating room as well as ideal assembling conditions at the finish. The actual consumption of cyanide will be less than by present method which is very antiquated and the furnace repairs will be reduced 90 per cent.

Question.—The man who has been plating at this shop for several years past died recently, and I have been told to take his place. Many things about the plating room are arranged differently from what I believe they should be. A nickel tank has a little old resistance coil connected in the anode line from the dynamo instead of in the line used for the work to be plated. The superintendent says, "Leave it alone." Please tell me if it should be changed. I have never seen a switch on an anode rod before.

Answer.—It is customary to place the resistance coil in the negative line. The position of the resistance with reference to negative or positive side of the circuit does not alter the result. The tank coil must be near the tank for satisfactory control, however. One ampere of electricity equals one volt divided by one ohm. To reduce the strength of the current it is possible to obtain results by inserting the resistance coil at a convenient point on either negative or positive line. There are many platers who operate all plating solutions with resistance coils in positive line and contend that the more logical position for the resistance is at a point where the current enters the solution rather than at a point where the current leaves the solution. In fact it is immaterial with all other factors being the same, you will accomplish equally as much by using th coil in the present position and avoiding display of officiousness on the part of the superintendent. He should have explained the case to you.

Question.—During the past three years a large amount of scrap copper in the form of chips, defective bands and pieces of sheet copper has accumulated in the shop. Prices recently quoted by metal buyers have not been attractive and the superintendent claims we can manufacture enough copper carbonate from the scrap to supply our plating room with carbonate for years, and at less cost than even the normal market price for the carbonate. Before attempting to try out the suggestion we desire some definite information concerning the approximate amount of copper carbonate which may be obtained from a given amount of metallic copper in the form we mention herein. Would you consider the idea an economic one for our purpose?

Answer.—The conversion of metallic copper into copper carbonate in quantities such as you have reference to would require an expensive equipment and the supervision of a practical man to obtain even fair results. The metal must be converted into some salts such as copper sulphate before a carbonate can be obtained. To obtain the sulphate it is necessary to oxidize the copper and then dissolve the oxide in sulphuric acid, forming $CuSO_4$ or copper sulphate. The action of sulphuric acid, either concentrated or dilute, on metallic copper, is not sufficiently strong to make the process practical for industrial purposes, therefore the copper is oxidized and the oxide dissolved by the acid. Lead-lined towers are sometimes used to facilitate the oxidation of the copper, the towers are loosely filled with copper scrap such as machine turnings, chips, and pieces of sheet copper, and dilute sulphuric acid is sprayed upon the metal from the top of the tower. When the reaction between the acid and the copper begins, heat is produced which causes a strong current of air to enter through an opening at the base of the tower. The air becomes heated, and after oxidizing, the copper passes out of the tower at the top. The dilute acid is pumped to the top of the tower and is again sprayed over the copper, the operation continuing until the metal is reduced. The copper sulphate solution which is thus obtained is allowed to cool and the copper sulphate crystals form and are collected and washed. To make the copper carbonate, the copper sulphate crystals are dissolved in hot water and the copper precipitated as carbonate by the addition of sodium carbonate. The carbonate thus formed must be repeatedly washed to remove all traces of sulphates or soda. The following figures will give you some idea of the approximate amount of carbonate obtainable from 100 pounds of metallic copper under favorable working conditions. Copper sulphate crystals ($CuSO_4.5H^2O$) contain 25.46 per cent. copper. 100 pounds of metallic copper should produce approximately 393 pounds of copper sulphate, and about 440 pounds of soda ash will yield about 194 pounds of copper carbonate ($CuCO_3$).

Copper sulphate is now obtained in large quantities as a by-product from various processes, and in normal times is very plentiful. We advise selling the copper scrap at present price and purchasing your supplies of copper carbonate as required; price of latter will no doubt decline to a very reasonable figure long before you would consume the amount obtainable from your metal and you would be unable to dispose of the carbonate at a profit. Is it not possible that you are using an excessive amount of copper carbonate in your plating solutions? Cyanide copper solutions can be very efficiently operated without any appreciable additions of copper carbonate, the solution being maintained in proper balance by the disintegration of the anodes. Furthermore, the anode is the cheaper source of metal supply for the bath and the method entails less labor and attention. We are of the opinion that your copper solution is employed too dense. Cyanide copper solutions operated at very low density will produce very rapid deposits perfectly. Tendency to blister, flake or curl is reduced. Maintenance cost is less and the solution is more easily managed. Naturally, due consideration must be given the current strength employed and a warm solution is much more satisfactory than one operated at ordinary room temperature. Equip the tank with the maximum anode surface possible and regulate the cyanide additions by the surface condition of the anodes. For example: If the anodes coat over with a blue black crust when bath is used and the coating dissolves off during short intervals between loads, no additions of cyanide are necessary. If the blue-black coating remains on the anode overnight or for a few hours, cyanide should be added in small quantities. Cyanide copper solutions with a color approaching a greenish yellow shade are more efficient than when of a light straw color. Do not allow the green tone to become too pronounced. Additions of cyanide should be made at the close of the day's work as alkaline copper solutions always work very irregularly immediately after the introduction of cyanide in quantities usually required. An old method which we have used may be of interest to you, and is as follows: Dissolve the copper in warm nitric acid diluted with an equal volume of water. When the acid has ceased to dissolve any more copper, dilute the solution to twice the original volume and precipitate the carbonate by adding sodium carbonate in small quantities until no further precipitation occurs, wash the precipitate several times and place on cloth strainer to remove surplus water; use same as carbonate made from the sulphate. Boil the copper solution a few minutes after each addition of carbonate.

Question.—Is nitre cake a Canadian product? What is its source and how is it used in commercial practice for pickling as a substitute for sulphuric acid?

Answer.—Nitre cake is crude acid sodium sulphate, and is a very variable substance. The free acid found therein may vary from 5 to 30 per cent. It is a by-product obtained in the manufacture of nitric acid and is produced in Canada in considerable quantities. Before the war the demands for this product were not sufficient to promote interest in the material. It is now used in the manufacture of paper and its use as a substitute for sulphuric acid in the pickling of metals is only of minor importance to the producers. It is used in aqueous solution at a temperature of 212 deg. Fahr. for pickling. Metal surfaces should be free from oils, greases, etc., to facilitate rapid action in pickling. It is of especial value in pickling annealed brass. The acid content should be maintained at from 3 to 5 per cent. by addition of fresh nitre cake. There is no gain in using a more highly concentrated solution. More rapid results are obtained by either agitating the solution or moving the metal undergoing treatment. The solution may be used with the electric current if desired, thereby effecting very rapid and thorough pickling at no extra expense excepting for power and in many shops this item would be negligible, as current from ordinary plating generator is all that is required.

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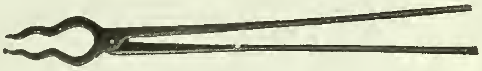

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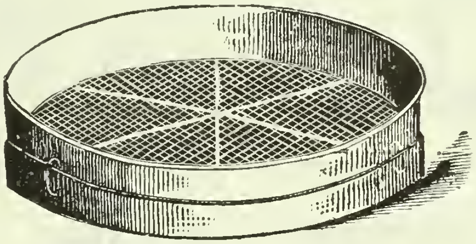

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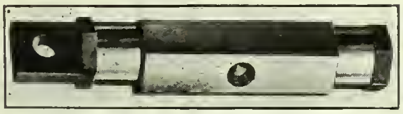
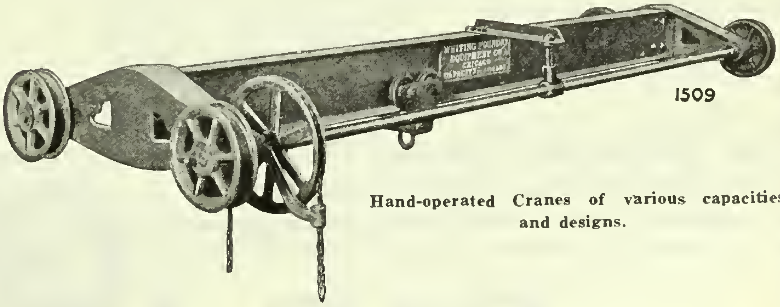


Branford Vibrators and Accessories.



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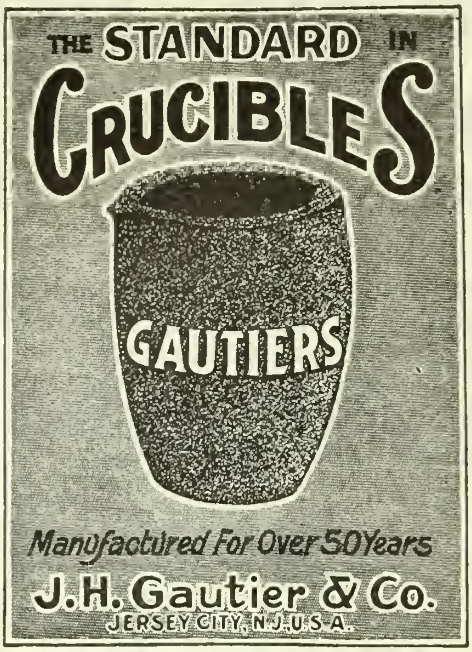

CLOSING TIME

Advertisements for this section must be in our hands on the 9th of each month.

In order that the announcements of your wants, etc., shall not be delayed, please try to have them in our office as early as possible.

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FOR SALE

BARGAIN IN USED ELECTRIC FURNACE—A one-ton Volta Electric Furnace for melting steel, grey iron or Ferro alloy furnace, 220 volts, 25 cycle, 3 phase; complete equipment. For further particulars write Hiram Walker & Sons, Metal Products, Limited, Walkerville, Ont., P.O. Box 156. (c.t.f.f.)

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WANTED—A TABOR MOLDING MACHINE squeezer No. 10—34" between upright, to be in A1 condition. State price. Apply W. J. Dalgleish, 221 Dundas St., Galt, Ont.

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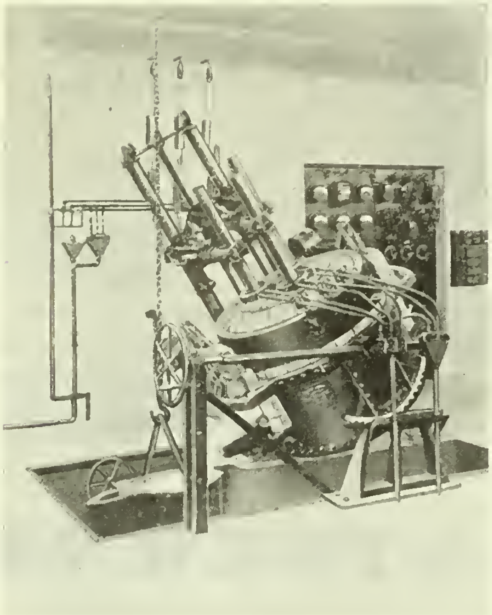

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Victoria Foundries, Ottawa.
International Malleable Iron, Guelph.
Katie Foundry, Galt.
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CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ANODES, BRASS, COPPER, NICKEL AND ZINC
W. W. Wells, Toronto, Ont.

ARGGON
Dominion Oxygen Co., Toronto, Ont.

BLOWERS, POSITIVE
P. H. & F. M. Roots Co., Connersville, Ind.

BRASS FURNACES
Hawley Down Shaft Furnace Co., Easton, Pa.

CHEMISTS
Charles C. Kawin, Chicago, Ill.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Indiana
Sullivan Machinery Co., Toronto, Ont.

COMPRESSORS
Sullivan Machinery Co., Toronto, Ont.

CORE MACHINES
American Foundry Equipment Co., New York City.
Wm. Demmer & Bros., Kewanee, Ill.

CORE OVENS
Damp Bros., Mfg. Co., Toronto, Ontario.
Monarch Engineering Mfg. Co., Baltimore, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Young Brothers Co., Detroit, Mich.

CORE PLATES
Damp Bros., Mfg. Co., Toronto, Ont.

CORE SAND
Benson & Patterson, Stamford, Ont
George F. Pettinos, Philadelphia, Pa.

CRANES
Northern Crane Works, Ltd., Walkerville, Ont.

CRUCIBLES
Joseph Dixon Crucible Co., Jersey City, N. Y.
J. H. Gautier & Co. Jersey City, N. Y.

CUPOLAS
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.

CUPOLA LININGS
Whitehead Bros., Buffalo N. Y.

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W. W. Sly Mfg. Co., Cleveland, Ohio.

EDUCATIONALISTS
McLain's System Inc., Milwaukee, Wis.

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Great Western Mfg. Co., Leavenworth, Kansas.
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Bailey & Bell Firebrick Co., Toronto, Ont.

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American Foundry Equipment Co., New York City.
Sterling Wheelbarrow Co., Milwaukee, Wis.

FLUXES, IRON, BRASS, ALUMINUM, COPPER
Basic Mineral Co., Pittsburgh, Pa.

Directory of Foundry Supply Houses

The Buyers Directory of Canadian Foundryman was originally intended to contain information regarding lines in the production of which the advertisers actually specialized. We now carry the advertising of leading supply houses, some of whom represent scores of manufacturers, in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the supply houses so we recommend that for all general requirements our subscribers communicate with the supply houses listed below:

Dominion Foundry Supply Co., Toronto, Montreal
The Hamilton Facing Mill Co., Limited, Hamilton, Ont.
Geo. W. Kyle & Co., New York
Frederic B. Stevens, Windsor, Ont.
The E. J. Woodison Company, Limited, Toronto, Ontario; Montreal, Que.

GRIT AND SHOT, SAND-BLAST
Pangborn Corp. Hagerstown, Md.

LADLES
Damp Bros., Mfg. Co., Toronto, Ont.

LADLE SHANKS
Damp Bros., Mfg. Co., Toronto, Ont.

MAGNETS
Dings Magnetic Separator Co., Milwaukee, Wis.

FLUOR SPAR
Basic Mineral Co., Pittsburgh, Pa.

FOUNDRY ENGINEERS
Austen Company, Cleveland, Ohio.
Charles C. Kawin, Chicago, Ill.
H. M. Lane Co., Detroit, Mich.
McLain's System Inc., Milwaukee, Wis.

FURNACES, OIL
Hawley Down Draft Furnace, Easton, Pa.
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES, GAS
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES COKE
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES ELECTRIC
Pittsburgh Electric Furnace Corp., Pittsburgh, Pa.

GRINDERS, PORTABLE
A. W. Sainsbury, Ltd
Cleveland Pneumatic Tool Co., Toronto, Ont.

GRINDERS, SWINGING
A.W. Sainsbury Lt., Sheffield, England.

HEATERS
E. J. Woodison & Co., Toronto.

HOSE COUPLINGS
Cleveland Pneumatic Tool Co., Toronto, Ont.

INDUSTRIAL ENGINEERS
H. M. Lane Co., Detroit, Mich.

IRON CEMENT
Smooth-On Mfg. Co., Jersey City, N.J.

KAOLIN
Whitehead Bros., Buffalo N. Y.

MAGNETIC SEPARATORS
Dings Magnetic Separator Co., Milwaukee, Wis.

METALLURGISTS
McLain's System Inc., Milwaukee, Wis.
Charles C. Kawin, Chicago, Ill.

METAL PATTERNS
Bryant Pattern Works, Windsor, Ont.
Hamilton Pattern Wks., Toronto, Ont.

MOLDING MACHINES
American Foundry Equipment Co., New York City.
Chicago Molding Machine Co., Chicago, Ill.
Arcade Mfg. Co., New York City.
Benson & Patterson, Stamford, Ont.
Herman Pneumatic Tool Co., Pittsburgh, Pa.
Wm. H. Nicholls Co., Brooklyn, N.Y.
Osborn Mfg. Co., Cleveland, Ohio.
Tabor Mfg. Co., Philadelphia, Pa.

MOLDING SANDS
Whitehead Bros., Buffalo N. Y.
Benson & Patterson, Stamford, Ont.
Geo. F. Pettinos, Philadelphia, Pa.
Venango Sand Co., Franklyn, Pa.

OXYGEN
Dominion Oxygen Co., Toronto, Ont

PATTERN MAKERS
Bryant Pattern Works, Windsor, Ont
Hamilton Pattern Wks, Toronto, Ont

PIG IRON
A. C. Leslie & Co., Ltd., Montreal.
Steel Co., of Canada, Hamilton, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto, Ont.

PULLEYS
Dings Magnetic Separator Co., Milwaukee Wis.

RIDDLES
Great Western Mfg. Co., Leavenworth, Kansas.
The Preston Woodworking Machine Co., Preston, Ont.

SAND
Benson & Patterson, Stamford, Ont.
George F. Pettinos, Philadelpbia, Pa.
Venango Sand Co., Franklyn, Pa.
Whitehead Bros., Buffalo N. Y.
United States Selica Co., Chicago, Ill.

SAND CUTTING MACHINES
American Foundry Equipment Co., New York City.
H. L. Wadsworth, Cleveland, Ohio.

SAND MIXERS
Philips & McLaren Co., Pittsburgh, Pa.
National Engineering Co., Chicago, Ill

SAND SIFTERS
Great Western Mfg. Co., Leavenworth, Kansas.
National Engineering Co., Chicago.
The Preston Woodworking Machine Co., Preston, Ont.

SAND BLAST HELMETS
Pulmosan Safety Equip. Co. Brooklyn.

BLOWERS, POSITIVE
P. H. & F. M. Roots Co., Connersville, Ind.

SAND BLAST MACHINERY
American Foundry Equipment Co., New York City.
Hoevel Mfg. Co., Jersey City, N.J.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio

SAND MULLERS
National Engineering Co., Chicago, Ill

SAND BLAST ABRASIVES
George F. Pettinos, Philadelphia, Pa
Globe Iron-Crush & Shot Company, Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND RAMMERS
Cleveland Pneumatic Tool Co., Toronto, Ont.

SHOT AND GRIT, SAND-BLAST
Pangborn Corp. Hagerstown, Md.

SNAP FLASKS
American Foundry Equipment Co. New York City.
Damp Bros., Mfg. Co., Toronto, Ont.
Diamond Clamp & Flask Co., Richmond, Indiana.

SNAP FLASK JACKETS
Damp Bros., Mfg. Co., Toronto, Ont.

STEEL BANDS
Damp Bros., Mfg Co., Toronto, Ont.

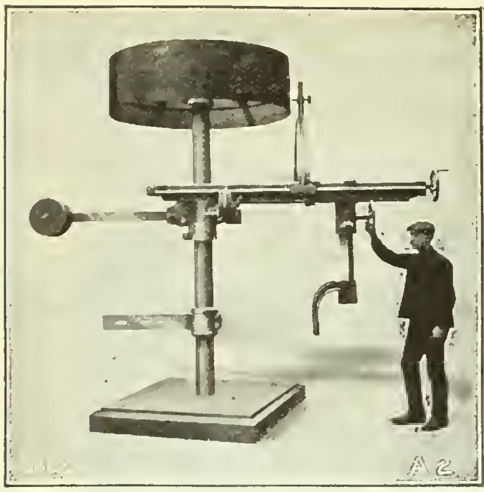
TUMBLING BARRELS
R. MacDougall Co., Galt, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio

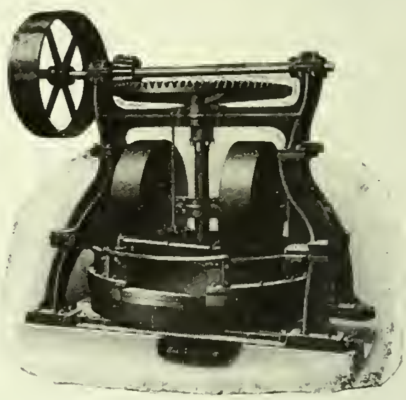
VALVES
Cleveland Pneumatic Tool Co., Toronto, Ont.

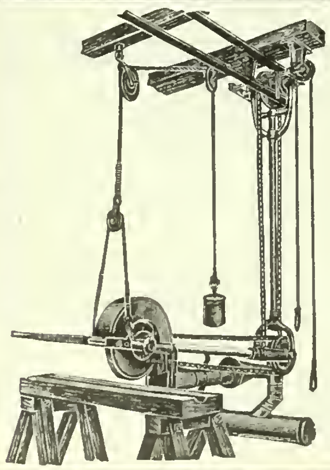
VENT WAX
United Compound Co., Buffalo, N Y

WELDING AND CUTTING SUPPLIES
Dominion Oxygen Co., Toronto, Ont.

WHEEL BARROWS
Sterling Wheelbarrow Co., Milwaukee, Wis.







INDEX TO ADVERTISERS

Going To The Rochester Convention?

Be Sure To Look Us Up

BOOTH 242

If we haven't met you, we want to.
And if we have met you, let's renew the acquaintance.
We want to show you our minerals and explain our Fluxes

Fluxes for All Metals **No Pay Unless Satisfactory**

Iron Flux in the Cupola

1. Saves Coke ten to twenty per cent.
2. Saves Iron two to six per cent.
3. Cuts Losses in two in job shops.
4. Drops bottom clean every time.
5. Doubles the life of the brick.
6. Shortens heat ten to twenty per cent.

FOR THE IRON

Makes Iron hot, 20 to 30 per cent. more fluid, twelve per cent. softer and absolutely clean. Makes castings tough, smooth and strong. Less trouble from shrinkage and porousness.

What our Iron Flux does for Iron, our Radioclarite accomplishes in Non-Ferrous Metals. Saves dollars where we make cents.

For Iron, Steel and Semi-Steel, use Keystone Thermo Molybdenum Flux.
For Chilled Rolls and Special Work, use Tungsten Ladle Flux.
For Brass, Bronze and Non-Ferrous Metals, use Radioclarite.
Try our Pearlite for Aluminum and our Special Radioclarite for Copper.

It Costs Nothing To Try Our Fluxes


C. M. MILLER

Send To-day For A Trial Order

FLUOR SPAR

We produce all grades of Fluor Spar from our own mines. Immediate delivery.

The Basic Mineral Co., **Box 276, N.S. Pittsburgh, Penna.**

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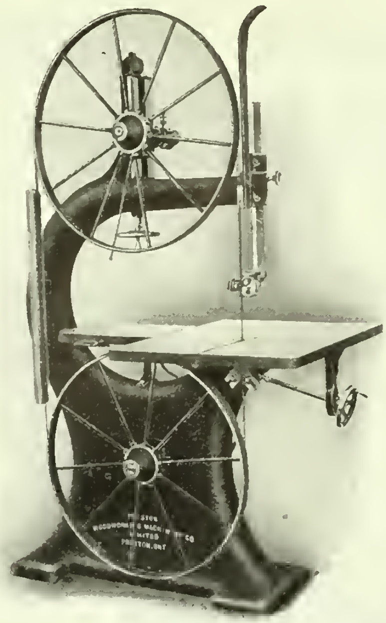
CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England.

Vol. XIII Publication Office, Toronto, June, 1922 No. 6

"PRESTON"



WOODWORKING MACHINERY

Guarantees Better Work in your Pattern Shop

This is our

BUZZ PLANER AND JOINTER

Neither skilled labor nor material have been spared to make this Buzz Planer and Jointer the most modern and up-to-date of any made to-day. It is practically perfect in every feature. The design is simple, the adjustments are convenient and, with ordinary care, it should never get out of order.

Use it for rabbetting, grooving, gaining, chamfering, beading, beveling, squaring up, making molds of various shapes, etc., and it will meet your most exacting demands.

Preston Electric Sand Riddle

A portable machine, durable and smooth running, which can be attached to any electric light socket. It will riddle your sand as fast as a man can shovel it in —and all it costs is

One Cent an Hour for Power!

There's no overhead equipment required, simply run it where you like and it will take care of your whole molding shop.

Put it on trial alongside any other Riddle at your plant and convince yourself that it is the fastest and most economical Riddle on the market.

The Preston Woodworking Machinery Co.

LIMITED

PRESTON, ONTARIO, CANADA

Dominion Oxygen Service

now includes

PREST-O-LITE Dissolved Acetylene

USERS of welding and cutting apparatus will appreciate this new and better service — one source of supply for both Dominion Oxygen and Prest-O-Lite Dissolved Acetylene.

The same high quality will be maintained in both the oxygen and fuel gas as has always distinguished these products.

The same types of cylinders will be continued under the new arrangement.

The advantage and the saving to you will come from placing your orders with one Company for *both* Dominion Oxygen and Prest-O-Lite Gas—thus always securing an adequate supply of both at the time and place you need them.

Telephone, telegraph, or write your orders to our nearest Distributing Station for immediate shipment by the shortest route.

DOMINION OXYGEN COMPANY, LIMITED

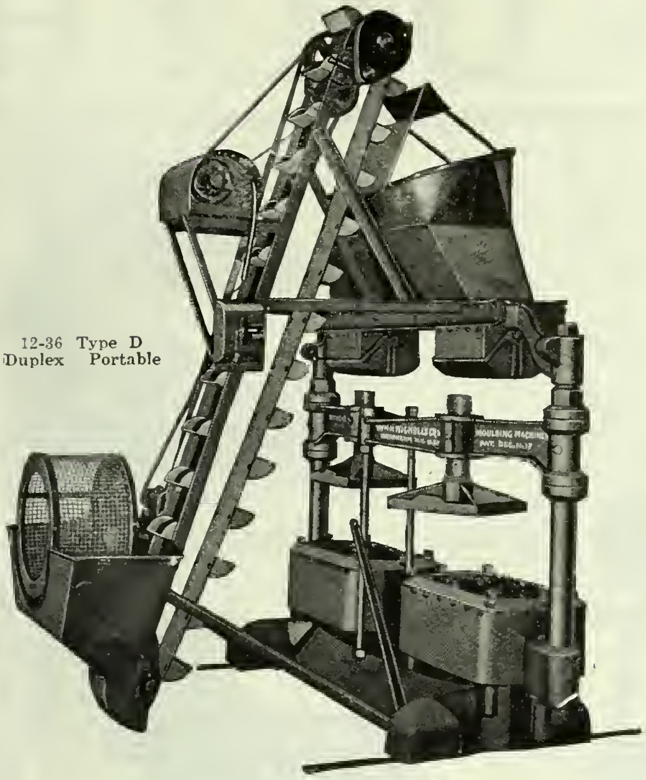
Operating the Welding and Cutting Gas Division of
PREST-O-LITE COMPANY OF CANADA, LIMITED

Hillcrest Park, Toronto.

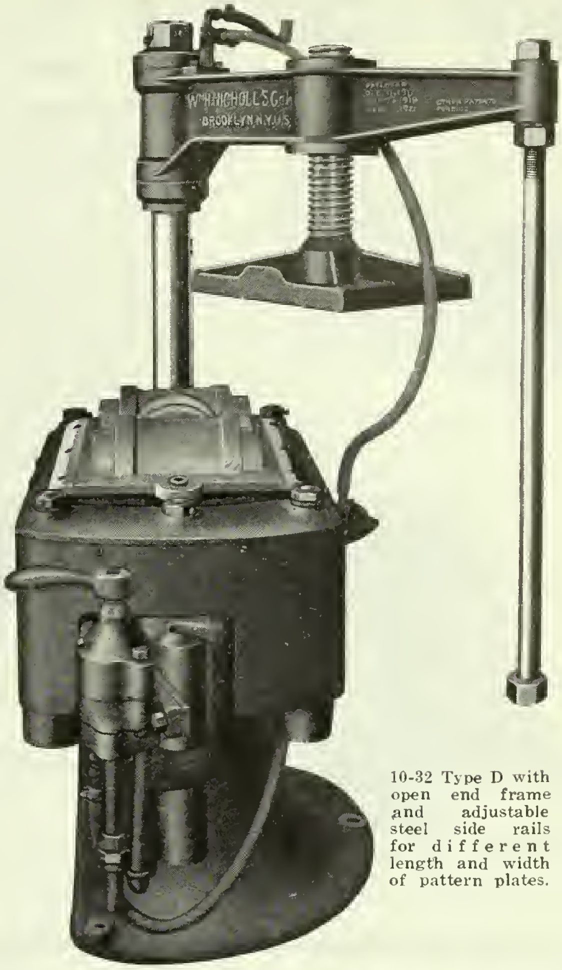
Shawinigan Falls, Quebec, Montreal, Hamilton, Merritton,
Welland, Windsor, Winnipeg.

D27

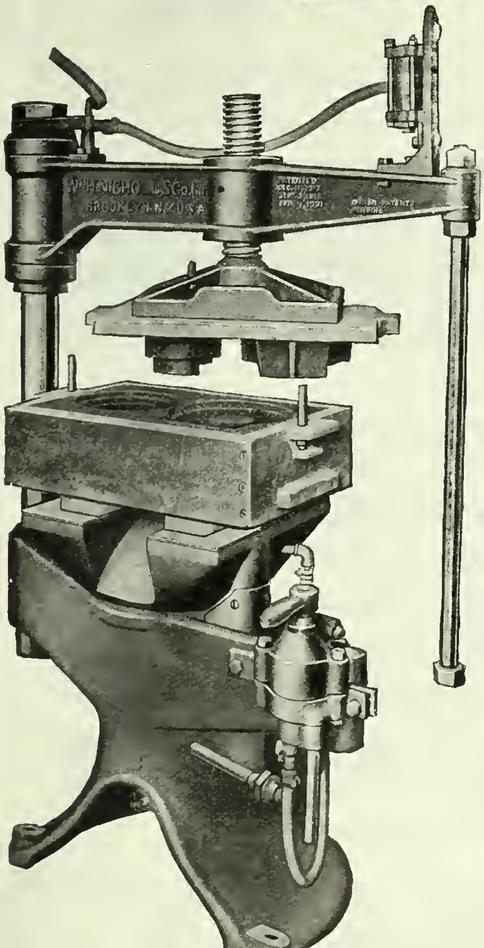
NICHOLLS MOLDING MACHINES



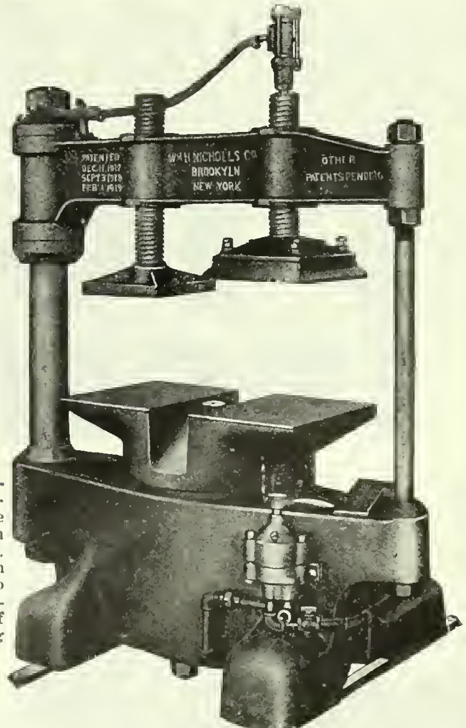
12-36 Type D Duplex Portable



10-32 Type D with open end frame and adjustable steel side rails for different length and width of pattern plates.



10-32 Type E Jolt Squeeze and electric drawing device.



14-42 Combination Duplex Portable Jolt, Squeeze and Pattern drawing device. This combination can be made up with three different types of heads or drawing devices.

8-10 College Place
Brooklyn, N. Y.

WM. H. NICHOLLS CO., Inc.

10108 Detroit Ave.
Cleveland

Manufacturers for France, Italy, Belgium, Spain, and Switzerland, Glaenzer & Perreaud, 18 Faubourg du Temple, Paris, France

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Cut Your Blasting Costs in Half

By Using

Globe H. C. Chilled Shot

Facts Worth Knowing.

Globe H.C. Chilled Shot has the highest abrasive quality.

Does not pulverize or go to dust like sand.

Blasting surface is left clean.

Gives you a better job at a greatly reduced cost.

Does better and faster work than sand, and will eliminate more than 50% of the dust incidental to sandblasting.

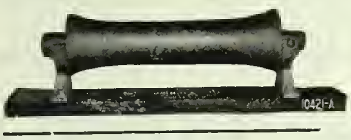
One ton of Globe H. C. Chilled Shot will outserve a whole carload of the best blasting sand, as the shot can be used over and over again—from 250 to 275 times. Think of the immense saving this means in the cost of blasting material.

The elimination of large storage bins and sand driers, also the saving in time and cost of transportation and unloading, are further reasons why you should use Globe H. C. Chilled Shot in preference to sand.

Start to economize by writing for further particulars and the names of progressive foundries using Globe H. C. Chilled Shot. Samples of sizes to suit your machines and prices gladly furnished.

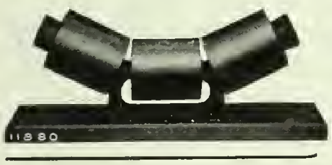
The Globe Iron-Crush GLOBE **and Shot Company**
(Formerly the Globe Steel Co.)

Department "C" Mansfield, Ohio

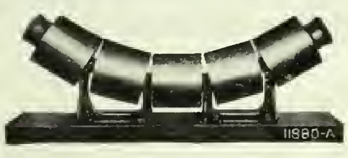


BELT CONVEYORS

Link-Belt belt conveyors have won the same success in the handling of materials under conditions for which they are adapted as Link-Belt equipment has achieved in the general field of elevating and conveying.



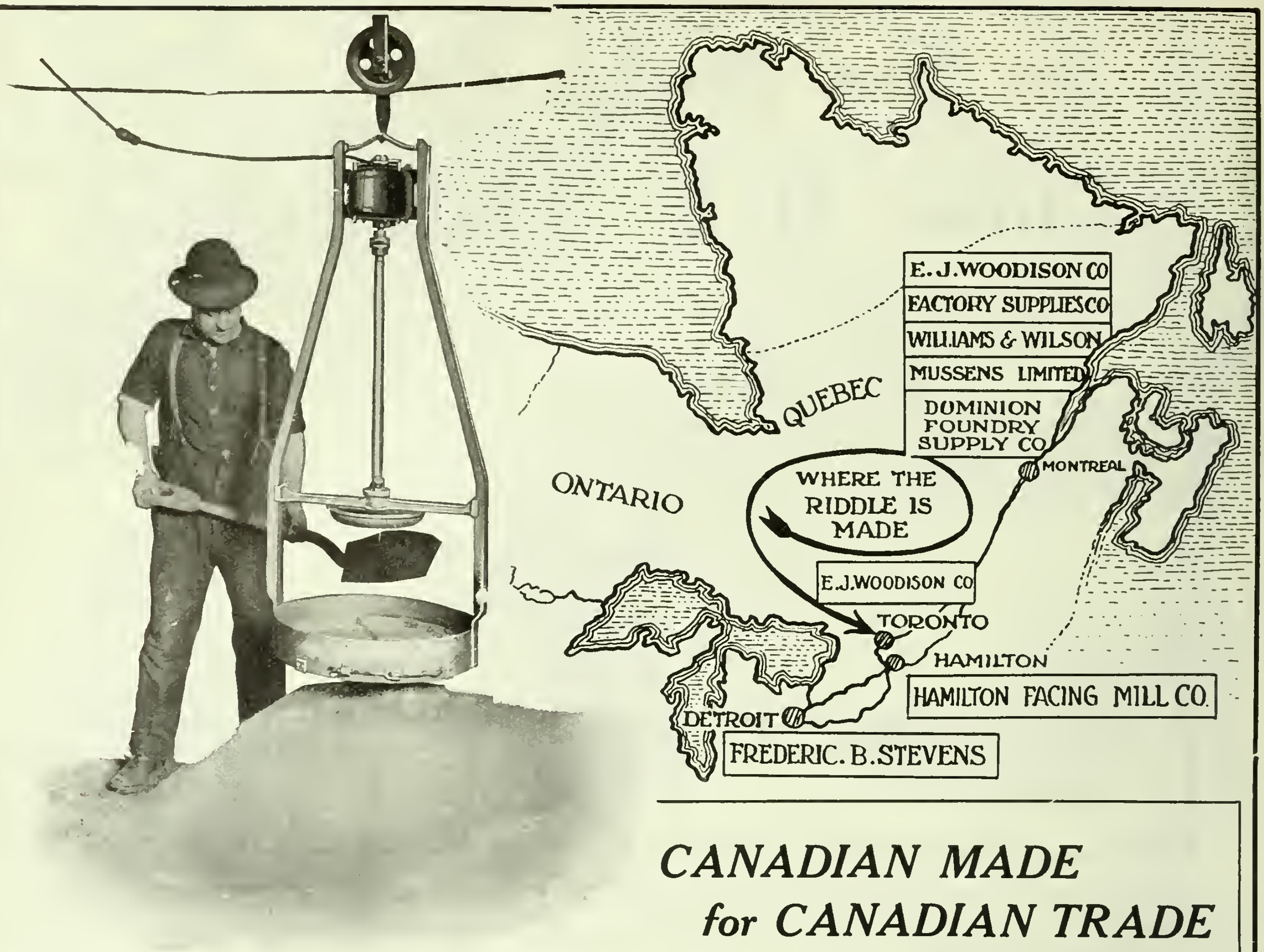
We manufacture all approved designs of elevators and conveyors, both belt and chain, and without prejudice, employ each where it serves best. Send for catalog No. 215.



CANADIAN LINK-BELT CO., LTD.

Toronto: Wellington & Peter Sts. **Montreal:** 10 St. Michael's Lane

LINK-BELT



CANADIAN MADE for CANADIAN TRADE

COMBS Gyratory Foundry RIDDLE

CANADIAN FOUNDRYMEN are proud of the Combs Riddle—proud of the fact that right here in Canada we make a Riddle that will more than "hold up its end," by comparative test, with any imported article. As a matter of fact, no one man can feed a Combs faster than it will sift, by actual test and experience of Canadian Foundrymen, the Combs will do more work than any ten men—and better work, too.

Then again, unlike many, so-called, portable Riddles, the Combs is really portable. You can use it in a dozen different places within an hour.

Get in touch with one of the concerns listed here—ask them to send you a Combs Riddle for 30 days' free trial. Costs you nothing — freight charges are on us.

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Hamilton Facing Mill Co., Hamilton.

Frederic B. Stevens, Larned and 3rd Sts., Detroit, Mich.

QUEBEC AGENTS

Dominion Foundry Supply Co., 185 Wellington St. Montreal.
Mussens, Limited, 211 McGill St., Montreal.
Factory Supplies, Ltd., 244 Lemoine St., Montreal.
Williams & Wilson, 84 Inspector St., Montreal.
E. J. Woodison Co., Montreal.
Strong-Scott Mfg. Co., Winnipeg, Manitoba.

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Member of the "Audit Bureau of Circulations"

Established 1909 Published Monthly

Convention Well Attended and Appreciated

While Not Surpassing Former Maximum in Numbers the Rochester Convention Outclassed All Its Predecessors in Innovations and Was Well Up in Number of Exhibits and Registrations

AFTER a lapse of nearly two years the American Foundrymen's Association in conjunction with the various other organizations with which it is allied met in convention at Rochester, N. Y., during the week of June 5th and held what was in many respects the best exhibition of foundry equipment and supplies of any in the history of that organization.

The number of exhibits was not quite up to that of the two preceding ones but was not far short.

The slight falling off was not through any lack of interest but was due to the fact that the machine tool department which has of late been taking an active interest was not as well represented as in former years.

Machine tools while of some interest to foundrymen are not directly connected with the business and the manufacturers of this class of machinery failing on this particular occasion to see sufficient encouragement in their line reflects nothing on what the manufacturers of foundry equipment are doing.

The display of molding machines and sundry sand conditioning and other machines surpassed anything heretofore shown. Many new ideas never before brought out were in evidence, some of which will be described in this issue. 338 booths were required to accommodate the exhibits, which is a good showing, considering conditions as they have been since the last convention, and argues well for the success of future conventions and exhibitions.

With the exception of the extra number of local callers which would register in a larger city the attendance was well up to the best of the past gatherings.

The number of Canadians who attended was probably in excess of that at any previous convention. Following are the visitors from Canada who registered:

Visitors from Canada

A. G. Howard, Brantford, Ont.; W. Phillips, Hamilton, Ont.; J. H. Punchey, Hamilton, Ont.; J. C. Wilkinson, Hamilton, Ont.; Stanley Adamson, St. George, Ont.; G. L. Havel, Montreal, Que.; C. D. Garner, Toronto, Ont.; A. Baillott, Hull, Que.; R. A. Calvert, Smith's Falls, Ont.; A. Z. Cohen, Montreal, Que.; P. Graham, Montreal, Que.; W. G. Davidson, Vancouver, B. C.; George H. Hammond, Guelph, Ont.; Emil Drolet, Quebec City, Que.; A. K. Hockin, Guelph, Ont.; W. L. Gifford, St. John, N. B.; C. E. Plummer, Bolton, Ont.; Robert Savelle, Guelph, Ont.; C. F. Stevens, London, Ont.; A. J. Palmer, London, Ont.; Frank A. Park, Oshawa, Ont.; Milton A. Taylor, Guelph, Ont.; Alex. R. Waldren, Brantford, Ont.; Mrs. A. R. Waldren, Brantford, Ont.; E. Lifeborn, Montreal, Que.; Geo. O. Vair, Kitchener, Ont.; John D. Meister, Welland, Ont.; E. H. Gurney, Toronto, Ont.; C. A. Roberts, Toronto, Ont.; F. Smith, Orillia, Ont.; R. M. Scott, Orillia, Ont.; A. E. Cambridge, Montreal, Que.; W. M. Maybank, Toronto, Ont.; F. J. Ross, Toronto, Ont.; Gerald Cavanagh, Montreal, Que.; John Cavanagh, Montreal, Que.; Harvey Carmichael, St. Catharines, Ont.; Henry Cunningham, St. Catharines, Ont.; W. R. Meldrum, Niagara Falls, Ont.; B. L. Jirouch, Guelph, Ont.; W. J. Dalgleish, Galt, Ont.; J. Bibbey, Toronto, Ont.; L. L. Anthes, Toronto, Ont.; John Davidson, Brampton, Ont.; Joseph Sully, Toronto, Ont.; Thomas Sully, Toronto, Ont.; J. E. Morden, Hamilton, Ont.; E. B. Fleury, Toronto, Ont.; E. J. Anderson, Welland, Ont.; J. P. Tracy, Toronto, Ont.; W. B. Muir, Toronto, Ont.; Gilbert C. Storey, Toronto, Ont.; T. W. Turner, Toronto, Ont.; W. W. Bowring, Windsor, Ont.; F. Roberts, Peterboro, Ont.; A. H. Ahara, Toronto, Ont.; Wm. G. Beatty, Fergus, Ont.; Mrs. W. G. Beatty, Fergus, Ont.; Findlay Bros. Co. Ltd, (ten in number) Carlton Place, Ont.; C. S. Gilbert, St. Thomas, Ont.; J. J. Gillen, Toronto, Ont.; A. C. Adams, Fort William, Ont.; W. A. Hastings, Hamilton, Ont.; Walter J. Langston, Three Rivers, Que.; Alfred Congdon, Port Arthur, Ont.; A. Mullen, Montreal, Que.; L. A. Potvin, Peterboro Ont.; A. H. Corney, St. Catharines, Ont.; W. H. Cameron, St. Catharines, Ont.; A. Chase, Hamilton, Ont.; D. W. Maxwell, St. Mary's Ont.; George B. Frost, Smith's Falls, Ont.; Walter A. Stewart, Smith's Falls, Ont.; G. M. Smith, Toronto, Ont.; W. B. Craig, Toronto, Ont.; Thomas Daly, Hamilton, Ont.; R. Catton, Toronto, Ont.; C. C. Beah, Ottawa, Ont.; E. M. Benedict, Toronto, Ont.; A. Bergman, Hamilton, Ont.; Robert Broadbent, Sherbrooke, Que.; M. J. Cahill, Lachine, Que.; R. A. Calvery, Smith's Falls, Ont.; Arthur Cambridge, Toronto, Ont.; C. M. Chase, Toronto, Ont.; Howard E. Farley, Brantford, Ont.; A. E. Coulter, Toronto, Ont.; Egmont L. Frankel, Toronto, Ont.; Ray Gleason, Hamilton, Ont.; E. J. Goodman, Oshawa, Ont.; H. J. Hawse, Guelph, Ont.; Wm. F. Hayes, Hamilton, Ont.; C. G. Heiby, Sarnia, Ont.; O. M. Hindson, Oshawa, Ont.; A. R. Hockie, Guelph, Ont.; M. Holland, Peterboro, Ont.; C. V. Inglis, Toronto, Ont.; Leon K. Lane, Ottawa, Ont.; C. A. Lauson, Toronto, Ont.; Geo. K. Lambling, Toronto, Ont.; Charles Linklater, Hamilton, Ont.; A. G. McIntyre, Toronto, Ont.; P. McMichael, Toronto, Ont.; D. T. McPherson, Toronto, Ont.; J. K. Moffat, Weston, Ont.; J. M. C. Moore, London, Ont.; J. E. Mordon, Hamilton, Ont.; Charles A. Roberts, Toronto, Ont.; A. Mitchell, Montreal, Que.; George H. Weaver, Montreal, Que.; E. N. Ward, Toronto, Ont.; Wm. Ruddy, Toronto, Ont.; A. Reynolds, Oshawa, Ont.; Frank A. Douglas, Chippawa, Ont.; B. G. Newton, Toronto, Ont.; F. H. Bell, Toronto, Ont.

The convention was opened at ten o'clock on Monday morning in the Auditorium building by an address of welcome from Mayor Clarence D. Van Zandt of Rochester. Owing to unavoidable absence of President W. R. Bean of the American Foundrymen's Association, who was ill, the mayor's address was responded to by W. B. Price, of Waterbury, Conn., chairman of the Institute of Metals division. C. R. Messenger, vice-president of the Foundrymen's Association also spoke, after which the convention was declared formally opened. The morning was spent in shaking hands and getting well acquainted with each other and in getting everything in shape for smooth sailing during the remainder of the week.

International Session

In the afternoon the international session was held, the speakers including

F. J. Cook of the British Foundrymen's Association, M. Remi of the French organization and others. In the evening the past and present officers of the institute of metals division were tendered an alumni dinner at the Powers hotel which finished the first day's programme.

The programme of sessions throughout the week was for the most part fairly as scheduled although the molding sand committee seemed to have some difficulty in holding their place even to being forced onto the deck of the excursion steamer on Thursday afternoon.

Needless to say this session had to be still further postponed as a couple of orchestras and decks covered with light-footed bipeds of both sexes made short work of molding sand. This subject was, however, well taken care of on Friday morning.

The Exhibits

Following is a list of the exhibits, together with the representatives:

Acheson Graphite Company, Niagara Falls, N.Y.:—Acheson Electrodes; Acheson Welding Electrodes; Cross-Section of Standard Joint; Acheson Foundry Facing.

Represented by Atwood B. Oatman, Fred E. O'Neil, Stanley L. Walworth, Lyman C. Judson.

Air Reduction Sales Company, New York, N.Y.:—Airco-Davis-Bournonville specially designed machines for automatic oxyacetylene welding and cutting (radiagraph, oxygraph, camograph and tube-welding) and hand welding and cutting torches.

Represented by A. D. Frost, J. L. Anderson, H. H. Melville, H. A. Hocking, H. Hazen, F. J. Leger, A. Blaser.

Ajax Metal Company, Philadelphia, Pa.:—Ajax Process Ingots and specimen castings; Ajax Bull Bearing Alloy; a 60 K. W. Ajax-Wyatt and 30 K. W. Ajax Northrup Electric Furnace.

Represented by G. H. Clamer, W. J. Coane, Frank M. Willeson, Zeno D. Barns, C. F. Hopkins, Henry Gieseke, William Adams, Dudley Willcox.

American Foundry Equipment Company, New York, N.Y.:—Sand Cutters of various styles, sand blast equipment, hammer core machine, molding machine, flasks, pattern mounting compound, pattern mounting equipment.

Represented by Verne E. Minich, Elmer A. Rich, James Rigby, Jr., R. H. Kelley, R. S. Buch, David Coble, W. H. Schulte, R. H. Moore, R. H. Wallace, David Logan, Jerome E. Sweet, E. J. Turnbull, Charles G. Smith, John Donald Alexander, Hutton H. Haley, C. D. Steinmeier, Herbert T. Rich, C. B. Schneible, J. F. Nesbitt, P. S. Weiner, J. E. Buch, D. C. Coble, W. W. Wallace.

American Wood Working Machinery Co., Rochester, N.Y.:—Wood Working Machinery for Pattern Shops.

Represented by C. B. Foster, George Ely, R. T. Maston, A. H. Jones.

Arcade Manufacturing Company, Freeport, Illinois:—Three types of Moderns mounted with plates, Air Squeezers, Jolt Squeezers, Piston Ring Squeezers, Plain Jolters, Jolt with hand strip and air strip, Post Squeezer, and Brillion Pouring Devices.

Represented by E. H. Morgan, L. L. Munn, Henry Tscherning, Mentor Wheat, August Christen, G. D. Wolfley, R. E. Turnbull, Herman Meyers, Jas. A. Morgan.

Armstrong-Blum Mfg. C., Chicago, Ill.:—Marvel Hack Saw Machines, Automatic High Speed Saws, Metal Band Saw, Rod Cutters, Punch Shear and Bender.

Represented by Harry J. Blum, George J. Blum.

Asbury Graphite Mills, Asbury, N.J.:—Demonstration of Asbury Core Nash and Ceylon Foundry Facings.

Represented bp H. M. Riddle, H. M. Riddle, Jr., I. D. Adams.

E. C. Atkins & Co., Inc., Indianapolis, Indiana:—Silver Steel Saws, Foundry Plates, Kwik-Kut Power Hack Saw Machines, Metal Band Saw Machines and Canto! Wax Belt Dressing, Machine Knives. The display will be mechanical in that electric motors will be used in a unique manner to cause huge Circular Saws to revolve.

Represented by T. A. Carroll, R. D. Tompson, W. L. Sturtevant, Edward Norvell.

Atomized Products Corp., Evansville, Indiana:—Mineral Foundry Facing.

Represented by R. J. McSherry and B. U. Cain.

Austin Company, Cleveland, Ohio:—Photographic display of Foundry Construction and installation of equipment. Construction plans and specifications of Typical Foundry work.

Represented by O. D. Conover, H. E. Stitt, Geo. A. Bryant, Jr., C. F. Chard, H. L. Cornelison.

B. & J. Manufacturing Co., Springfield, Ohio:—A working demonstration of the New V-Roll Flask Guide.

Represented by George E. Jackson.

Bacharach Industrial Instrument Co., Pittsburgh, Pa.:—Blast Volume and Pressure Meters, Recording and Indicating.

Represented by L. J. Speidel, L. L. Vayda.

Balbach Smelting & Refining Co., New York, N.Y.:—N. B. C. casting copper ingots and ingot bars; B. B. B. yellow brass and composition ingots; Desilverized lead, antimonial lead, solder.

Represented by F. Schmutzer, James MacNee, R. H. Thomas, Thomas Thomson.

C. O. Bartlett & Snow Co., Cleveland, Ohio:—Sand Handling Equipment, Continuous Molding Equipment, Mechanical Carrying Equipment.

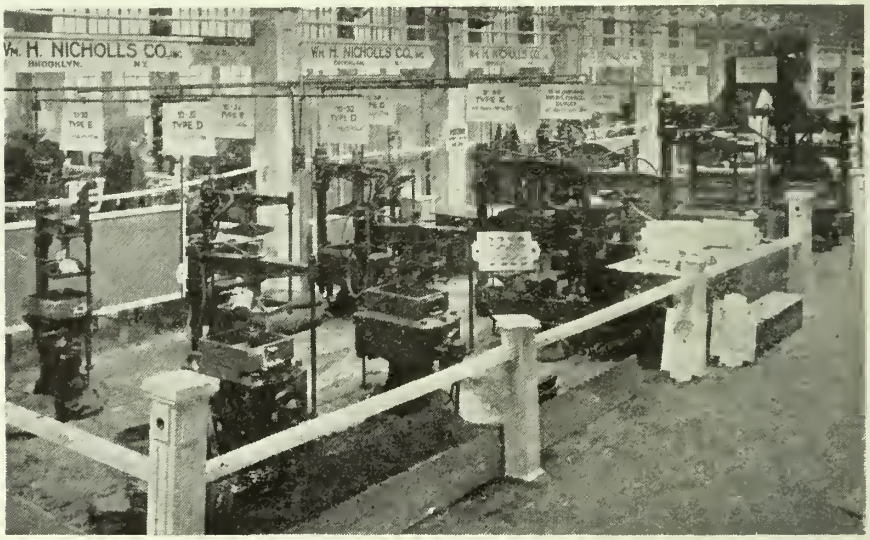
Represented by H. L. McKinnon, H. C. Orr, S. Gertz.

Basic Mineral Co., Pittsburgh, Pa.:—Miller fluxes, radioclarite keystone covering all metals.

Represented by E. E. Miller.

Bastian-Blessing Co., Chicago, Ill.:—Oxy-acetylene welding and cutting equipment in actual operation.

Represented by E. L. Mills, Fred Zwald, H.A. Solomon.



A booth full of molding machines at the Rochester Exhibition.

Bausch & Lomb Optical Co., Rochester, N.Y.:—Metallurgical Microscopes, Metallographic Cameras and other Scientific Instruments.

Represented by I. L. Nixon, G. H. Leffler, H. D. Skelton, M. Schmit, M. H. Stevens, R. J. Phillips, F. W. James

Beardsley-Piper Company, Chicago, Illinois:—Tractor and turntable Sand-Slingers for high production molding.

Represented by E. O. Beardsley, E. L. Mitchell, P. Stefan.

Beaudry & Company, Inc., Boston, Massachusetts:—Working model of the Beaudry "Champion" Power Hammer motor driven type.

Represented by Archibald Parsons.

Bennington Scale Mfg. Company, Bennington, Vermont:—Bennington Suspended Platform Heavy Duty Scales; Bennington Suspended Platform Counting and Weighing Machines.

Represented by A. N. Robbins, H. R. Coffin, W. G. Thompson, F. J. White, E. M. Banghart.

Bethlehem Steel Company, Bethlehem, Pennsylvania:—Illuminated Transparencies Illustrating Bethlehem Mayari nickel chrome iron ore property in Cuba, with products.

Represented by Robt. MacDonald, H. P. Kreulen, H. G. Walton, D. A. Barkley, A. J. Ecklep, W. R. Shimer.

S. Birkenstein & Sons, Inc., Chicago, Ill.:—Wizard Brand Metals; Ingots of various grades and descriptions and Castings made of same metal in different forms and stages of manufacture. Latest metal market reports.

Represented by George Birkenstein, Charles B. Rapheal, Matt Schero, Frank J. McCall, Eli Brown, Louis Birkenstein.

Black Diamond Saw & Machine Works, Inc., Natick, Massachusetts:—Band and Circular Saw Filing and Setting Machhines, Brazing Outfit, Saws and Saw Guides, Strand Flexible Shafts and Equipments.

Represented by W. B. Ambler, Clyde W. Blakeslee.

Blystone Mfg. Co., Cambridge Springs, Pa.:—Blystone Core Sand Mixer equipped with power discharge, screen and motor.

Represented by Luther G. Conroe, Ralph W. Barnes.

Bonnot Company, Canton, Ohio:—Photographs of the Bonnet installed Holbeck Pulverized Coal Systems for air melting furnaces, annealing ovens, boilers, etc.

Represented by Stockton Harter, E. W. Steele, Charles Longenecker.

Brass World Publishing Company, New York, N.Y.:—Trade publications.

Represented by G. A. Tanner and William F. Carns.

Carborundum Company, Niagara Falls, N.Y.:—Carborundum and Aloxite Grinding Wheels, Garnet Paper, Aloxite Cloth, Aloxite Polishing Grain, Carborundum Refractory Muffles, Refractory Brick and Refractory Cements.

Represented by W. W. Sanderson, O. C. Dobson, H. E. Kerwin, G T. Kretschmar, Geo. Rogers, C. E. Hawke, J. A. King.

Frank D. Chase, Inc., Chicago, Illinois: —Plans and photographs, examples foundry layout, design, and remodeling. Comprehensive data—present day new building equipment and alteration costs.

Represented by Frank D. Chase, L. M. Hanson, F. Graf, Jr.

Chicago Crucible Company, Chicago, Illinois:—Graphite Crucibles, Retorts, and Stopper Heads.

Represented by Sherman Taylor, Adolph F. Hottinger, LeRoy C. Taylor, J. W. Mann, James P. Foraker, H. C. Sorenson, J. G. Crowe, Howard E. Deign.

Chicago Pneumatic Tool Company, New York, NY.:—Air Compressors, Improved Portable Grinders (Air and Electric), Sand Rammers, Chipping Hammers, Air Hoists and Foundry Specialties.

Represented by A. E. Goodhue, A. C. Andresen, Nelson B. Gatch, Ross Watson, W. C. Straub, H. A. Ellis, George Allen, W. H. White.

The Charles J. Clark Blast Meter Co., Gladbrook, Iowa:—Blast Volume Meters, Velocity Meters, Pressure Gauges.

Represented by B. I. Harms.

Clark Tructractor Company, Buchanan, Michigan:—Gasoline Power Industrial Trucks and Tractors; Gasoline Power Industrial Elevating Platform Lift Truck.

Represented by Louis J. Schneider, G. M. Chase, J. W. Taylor, W. B. Eldred, A. O. Williams.

Cleveland Crane & Engineering Co., Wickliffe, Ohio:—Tramrail crane, equipped with carrier and electric hoist. Carrier with electric travel, hoist and platform. One ton hand power carrier with chain block, and one thousand pound hand power carrier with chain hoist.

Represented by C. C. Robbins, E. T. Bennington, J. B. Shaver, D. T. Laylin, F. J. Brittingham.

Cleveland Flux Company, Cleveland, Ohio:—Complete display of "Famous Cornell Fluxes" Electric display demonstrating Cornell Fluxes.

Represented by John C. Cornell, Loren E. Souers, Clifford B. Cornell, Elizabeth C. Weisblat.

Cleveland Pneumatic Tool Co., Cleveland, Ohio:—Sand Rammers, Core Breakers, Portable Grinders, Chipping and Riveting Hammers, Air Drills, Bowes Hose Couplings, Cleco Air Valves.

Represented by H. S. Covey, Arthur Scott, C. D. Garner, R. E. Manning, J. T. Graves.

Clipper Belt Lacer Co., Grand Rapids, Michigan:—Belt Lacing Tool and Lace for same.

Represented by Carl P. Field.

Thomas E. Coale Lumber Co., Bellevue Court Building, Philadelphia, Pa.:—Pattern Pine, Pattern Mahogany, Flask Lumber.

Represented by Thomas E. Coale, Samuel D. Pettit.

Cochrane-Bly Company, Rochester, N. Y.:—Metal Sawing Machine, Saw Sharpening Machine, Duplex Miller and Shaper, and Filing Machine.

Represented by W. H. Welch.

F. A. Coleman Co., Cleveland, Ohio: —Models of Clam Shell Bucket, Models of Lift Trucks.

Represented by F. A. Coleman.

Combined Supply & Equipment Co., Inc., Buffalo, N. Y.:—"AngleStem" and "Double Angle" (Patented) single piece double head Chaplets in five different gauges of metal.

Represented by S. LeViness, Jr., C. L. Jackson.

Davenport Machine & Foundry Company, Davenport, Iowa: — Davenport Jolt-Roll-Over Pattern Draw Machine, and Jolt Stripping Machine.

Represented by Carl Falk, A. V. Magnuson, John T. Anderson, A. D. Ziebarth.

Dayton Pneumatic Tool Co., Dayton, Ohio:—Floor and Bench Rammers and Chipping Hammers in operation. Riveting Hammers, hose couplings and accessories.

Represented by L. B. George, E. C. Thompson, Geo. C. Towle, Wm. Gleasner.

Debevoise-Anderson Co., Inc., New York, N. Y.:—Small hand Samples and Specimens of Cope, Pig Iron, Ores, Fluxing Stone, Ferro Alloys and Refractories.

Represented by Nils Anderson, C. A. Wyatt, Paul Brooks, W. K. Callow, A. E. Kelly, Chas. Pfeiffer.

Wm. Demmler & Bros., Kewanee, Illinois:— Demmler Air Operated Core machines in operation, showing multiple Faucet Cores, multiple Cock cores and valve cores standing.

Represented by H. L. Demmler, F. A. Demmler, J. T. Gillespie, W. B. Sandford, J. P. Nowry.

Detroit Electric Furnace Company, Detroit, Michigan:—Electric Furnaces, display of products made in Detroit Furnaces.

Represented by Ed. L. Crosby, Edward T. Gushee, Albert E. Rhoads, Harry M. St. John.

Henry Disston & Sons, Inc., Philadelphia, Pa.:—Milling Saws, Hack Saws, Files, and Metal Band Saws.

Represented by Joseph L. Dorrington and L. M. Willard.

Joseph Dixon Crucible Company, Jersey City, N. J.:—Graphite Crucibles, Sand and Clay Crucibles, Graphite Stoppers, Nozzles; Lead and Graphite Facings, Dixon's Core Wash, Dixon's Refractories.

Represented by J. A. Condit, H. L. Hewson, R. F. Leonard, R. H. Brinkerhoff, C. A. Shaw, R. R. Belleville, H. P. Smith, A. L. Haais.

Doehler Die-Casting Co., Brooklyn, N. Y.:—Doehler Die-Casting of Aluminum, Zinc, Tin and Lead Alloys, and "Do-Di" Finished Brass Castings.

Represented by H. H. Doehler, Charles Pack, C. E. Hart, E. R. Zabriskie.

Electric Furnace Company, Salem, Ohio:—Electric furnace brass melting equipment, including an electric furnace in complete operation, melting and pouring red brass, and a model unit showing construction. Pictures of actual foundry installations of furnaces in the United States and foreign countries.

Represented by T. F. Baily, R. F. Benzinger, F. J. Peterson, M. T. Ellis, R. F. Fletcher.

Electro Refractories Corp., Buffalo, N. Y.:—Crucibles and Fire Brick.

Represented by L. U. Milward, W. E. Howard, C. A. Asher.

Federal Malleable Company, West Allis, Wisconsin:—Rapid Molding Machines in actual operation. The new Rapid Squeeze Stripper Molding Machine on exhibition for the first time.

Represented by L. C. Wilson, K. H. Siemens, W. J. MacNeil, M. W. Gleisner.

Forbes & Myers, Worcester, Mass.:—Electric hand snagging Grinders, Tool Grinders, and Grinders for general purposes.

Represented by Ray S. Kail.

Foundry Equipment Company, Cleveland, Ohio:—Enlarged photographs of actual installations of Coleman Core and Mold Ovens in rolling drawer, car, shelf and portable rack types, also installations of Coleman Brass and Aluminum Melting Furnaces.

Represented by C. A. Barnett, R. W. Bronson, S. D Rickard, M. A. Beltaire, Jr.

General Electric Company, Schenectady, N. Y.:—Crucible Melting Furnace with Automatic Control Panel and Transformer. Portable Semi-Automatic Arc Welding Equipment operated by a 200 ampere portable motor-generator set, with necessary starting and control panel.

Represented by J. M. Hollister, H. A. Winnie, C. H. Lockwood, P. A. McTerney, J. W. Belanger, D. L. Cramb.

Gibb Instrument Company, Detroit, Mich.:—Zeus Arc Welders for reclamation of defective castings, Seam Welders, for welding seams in sheet metal.

Represented by H. L. Clark, W. H. Gibb.

The Globe Iron-Crush and Shot Company, (Formerly the Globe Steel Company), Mansfield, Ohio:—Complete line of samples Globe H. C. Chilled Shot, sand-blasting abrasive, together with sample castings showing results of its use.

Represented by L. A. Cline and E. O. Townsend.

Robert Gordon, Inc., Chicago, Ill.:—Working model of Mechanical Hot Blast Heater; Demonstrating Foundry Heater; also Photographs of installations.

Represented by T. H. Monaghan, A. L. Weixel, R. M. Zimmerman, J. L Zimmerman.

Great Western Manufacturing Co., Leavenworth, Kansas:—Combs Gyratory Sand Riddles in operation.

Represented by P. L. Wilson.

Grimes Molding Machine Co., Detroit, Michigan: — Grimes Hand Rammed Molding Machine, also 2,500 capacity Jar Rammed Rollover Pattern-Drawing Machine.

Represented by Chas. J. Skeffington, George L. Grimes.

Grindle Fuel Equipment Company, (Subsidiary of Whiting Corporation), Harvey, Illinois:—Catalogs, drawings, photographs, etc., of Grindle Powdered Fuel Equipment.

Represented by A. J. Grindle.

Gurney Scale Co., Hamilton, Ont.:—Type Registering Dial Scales. This scale prints and records the weights, prints tickets; in short, does for weighing what the cash register has done for the retailer.

Represented by J. E. Morden, A. W. White, J. N. Peden.

Hanna Engineering Works, Chicago, Ill.:—Cross section of Pneumatic Cylinder Hoist, showing piston and piston rod features. Large cross section photograph of the Mumford Air Jolt Machine. I-Beam Trolleys and Mumford Vibrators.

Represented by A. F. Jensen, J. C. Hanna, O. F. Weiss, J. O Clark.

Clement A. Hardy Company, Chicago, Ill.:—Photographs, blue-prints and sketches of Industrial Plants.

Represented by Clement A. Hardy.

R. G. Haskins Co., Chicago, Ill.:—Portable Machines, Flexible Shaft Equipments, buffing, grinding, polishing equipment for foundry and pattern shops.

Represented by R. G. Haskins.

E. F. Hauserman Co., Cleveland, Ohio: —"Fenestra Steel Windowalls."

Hayward Company, New York, N. Y.: —Bridge supporting hoists handling Hayward Electric Motor Bucket and Air Operated Hayward Orange Peel Bucket, with models, literature, etc.

Represented by H. M. Davison, H. S. Atkinson, C. S. Sargent, P. M. Armstrong.

Herman Pneumatic Machine Company, Pittsburgh, Pa.: Small working model of large type Independent Rollover and Pattern Drawing Machines.

Represented by Robert F. Ringle, I. J. Oesterling, R. P. Morgan, Robert M. Porteous, C. W. Miller, C. S. McMath, W. W. Hughes, Thos. Kavenp, A. G. Doyle, R. Harris.

High Speed Hammer Company, Inc., Rochester, N. Y.:—Several sizes High Speed Riveting Hammers, giving actual demonstration, heading large rivets cold; Demonstration of High Speed Motor-driven Sensitive Bench Drill Press. Brun Slotting Attachment for Shapers and planers.

Hoevel Manufacturing Corp., Jersey City, N. J.:—Hoevel automatic dustless, rotary table sandblast, revolving barrel sandblast machine, sandblast pressure tanks of various types.

Represented by James M. Betton, L. B. Passmore, Fred Welte.

Represented by C. W. Schuchardt.

Hill & Griffith Co., Cincinnati, Ohio:—Foundry Supplies and Equipment.

Represented by John Hill, Wm. Oberhelman, Bruce Hill, C. L. Gysin.

Holcroft & Company, Detroit, Michigan:—Photographs, literature and technical data on metallurgical furnaces, special attention being given to electric furnaces.

Represented by Charles T. Holcroft, Ruel T. Caldwell, Hiram L. Ritts.

Hyatt Roller Bearing Company, New York, N. Y.:—Hyatt roller bearings for cranes, trolleys, hoists, trucks, conveyors, sand mixing machinery, machine tools, cars, power transmission lines, and other foundry equipment. An electrically operated model showing a Hyatt bearing enclosed in glass.

Represented by D. Gleisen, W. B. Wachtler, John F. McGuinness and F. H. Knight.

Independent Pneumatic Tool Co., Chicago, Ill.:—Thor Pneumatic Clipping Hammers, Cleaning and Scaling Hammers; Pneumatic Sand Rammers; Portable Pneumatic Grinders and Electric Grinders; Motor Driven Air Hoists, and a complete line of Pneumatic Tools and Electric Tools for Foundry and Machine Shop use.

Represented by H. G. Keller, F. H. Charbono, F. J. Passino, H. F. White, A. Anderson, S. W. Lanham.

Industrial Controller Co., Milwaukee, Wis.:—Electric Controllers, automatic and manually operated A. C. Compensators, automatic starters, push button control.

Represented by J. H. Burroughes, R. G. Kellogg, F. W. Magin.

Ingersoll-Rand Co., New York, N. Y.: —Air Compression and Pneumatic Tools.

Represented by J. W. Anderson, Geo. C. Williams, W. A. Johnson, Geo. A. Gallinger, G. W. Winslow, F. G. Palen.

International Molding Machine Co., Chicago, Ill.:—Combination Power Turn-Over Machines, Combination Jolt Strip-

A few of the thousand odd excurtionists who crossedto Coburg, Ont. on the Steamer "Cayuga."

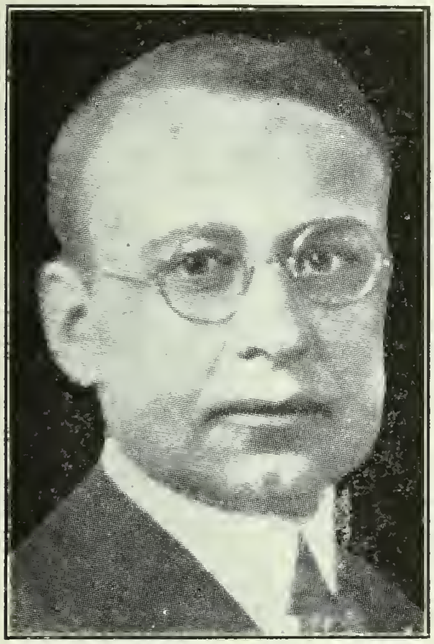
ping Machines, Hand Turn-Over Machines for Castings and Cores.

Represented by Edward A. Pridmore, F. W. Hamel, E. G. Borgnis.

Iron Age Publishing Co., New York, N. Y.:—The Iron Age.

Represented by F. J. Frank, C. S. Baur, F. W. Schultz, C. L. Rice, E. Sinnock, B. L. Herman, H. E. Barr, D. C. Warren, W. C. Sweetser, C. Lundberg, W. B. Robinson, A. L. Marsh, F. S. Wayne, Emerson Findley, Don. G. Gardner, W. W. Macon, E. F. Cone, R. E. Miller, C. E. Wright, C. F. Tegan, F. L. Prentiss, O. B. Bergersen, E. A. Trumpbour, A. H. Dix, B. H. Hayes, C. E. Lachaussee.

Spencer Kellogg & Sons, Inc., Buffalo,



C. R. MESSINGER
Newly Elected President.

N. Y.:—Complete line of Core Oils, also Cores and Castings made by foundries using Kellogg Core-oils.

Represented by W. L. Goetz, J. N. Yaeger, E. G. Allen, G. B. Chase, M. B. Nordlie.

Keystone Lubricating Co., Philadelphia, Pa.:—Lubricating Greases and Cups—Motor Driven Line Shafting, Illustrating the Application of Our Greases and Cups to Plain Bearings with our Gravity Feed Cups, Hyatt Roller Bearings and Ball Bearings.

Represented by H. W. Allen, Leo Englander, Arthur T. Lowry.

Julius King Optical Co., New York, N. Y.:—Complete line of Head and Eye Protection in all hazardous occupations in the foundry industry. Also a Unique Bulletin Service.

Represented by Julius King II, Joseph Duffy.

King Pneumatic Tool Co., Chicago, Ill.: —Pneumatic tools and accessories.

King Refractories Co., Buffalo, N. Y.: —"FLAME BRAND" High Temperature Cements for Fire Brick and Insulation Work, Patching, Rammed Linings and Baffles.

Represented by Sanford C. Smith, Ernest J. Eddy, Donald F. Shaw.

Kuehnle, Inc., Philadelphia, Pennsylvania:—Cores and moulds of many characters, samples of Core Oils in different grades, trade marks, advertising materials, etc.

Represented by C. Albert Kuehnle, James A. Burke, E. M. Satterthwaite.

H. M. Lane Co., Detroit, Michigan:—Photographs and drawings.

Represented by H. M. Lane, A. O. Thomas, G. Pitt.

Lava Crucible Company of Pittsburgh, Pittsburgh, Pa.:—"Lava" Crucibles. "Lavapatch" high temperature furnace cement. "Lavaflux" metal flux.

Represented by P. L. Berkey, Furman South, J. D. E. MacLean, A. J. Goekler.

The Leather Belting Exchange, Philadelphia, Pa.:—Educational exhibit to show relative transmission capacity of leather as compared with the various types of substitute belting in common use.

Represented by Louis W. Arny, Ralph F. Jones, Warren A. Stevenson.

Leeds & Northrup Co., Philadelphia, Pa.:—Potentiometer System of Pyrometry. Curve Drawing Recording Pyrometers for accurate time temperature control of Malleable Iron Ovens. Optical Pyrometers for temperature of ovens and pouring temperatures.

Represented bp Oscar Brewer, E. B. Estabrook.

Link-Belt Company, Chicago, Ill.:—Rapp Revivifier for Molding Sand, Electrical Hoist. Enlarged pictures showing installations of molding sand handling and preparatory machinery.

Represented by W. C. Carter, Geo. O'Connor, Geo. L. Morehead, Henry L. Waterbury, E. F. Mullin, S. L. Haines, A. G. J. Rapp, Howard MacNeil.

David Lupton's Sons Co., Philadelphia, Pa.:—Lupton Pivoted Sash, Lupton Counterbalanced Sash, Pond Continuous Sash, Pond Operating Device and Lupton Steel Factory Equipment. Model of Pond Truss foundry and photographs and cross section of large foundries with Pond roof design.

Represented by Clarke P. Bond, R. A. Sanborn, D. Water Lupton, J. H. Throm.

C. E. McArthur, Chicago, Ill.:—Model of Pneumatic or Steam Power operated rod straightener and Shear Machine.

Represented by W. M. Wilson.

J. S. McCormick Co., Pittsburgh, Pa.: Vulcan Blacking, Lion Binder, Foundry Equipment of all kinds.

Represented by J. S. McCormick, T. E. Malone, S. R. Costley, E. M. Lewis.

McPhee Cement Company, Inc., Scranton, Penna.:—"Hybond" high temperature fire brick cement.

Represented by L. G. McPhee, John S. Tiefel, Kenneth A. Stewart.

Machinery, New York, N. Y.:—Engineering publications.

Represented by A. C. Payne.

MacLean Publishing Co., Ltd., Toronto, Ontario, Canada:—Canadian Foundryman and Metal Industry News, Journal of the Foundry Trade of Canada.

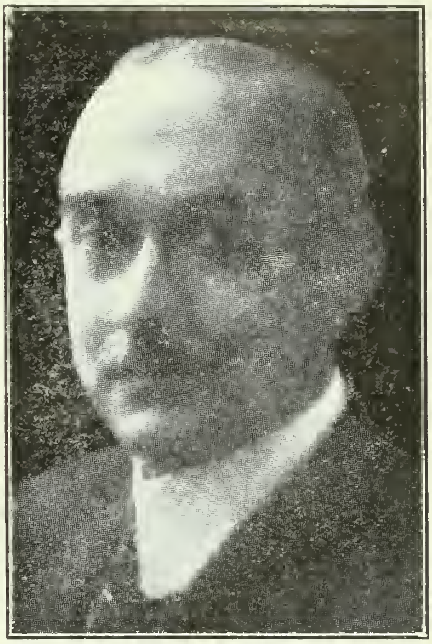
Represented by F. H. Bell, G. M. Smith, A. H. Byrne, S. S. Moore, W. L. Gifford, J. J. Gillen, B. G. Newton.

MacLeod Company, Cincinnati, Ohio: —Sand Blast Tumbling Barrels. Sand Blast Hose Machine complete. Model Screen Type Dust Arrester. Oil Burning Equipment.

Represented by James Lauder, Alfred Anderson.

Malleable Iron Fittings Company, Branford, Conn.:—Working model of the Branford Vib Riddle. Samples of vibrators, quick detachable hose couplings, new type patternmakers' vise, new water sprayer, continuous operating type of vibrator, etc.

Represented by G. B. Pickop, Frank Boskey.



G. H. CLAMER
Newly Elected Vice-President

Meachem Gear Corp., Syracuse, N. Y.: —New process raw hide pinions. Cut metal gears.

Mechanical Appliance Co, Milwaukee, Wis.:—Ball bearing electric motors, open and enclosed, specially adapted to Foundry Service.

Represented by W. B. Crabtree.

Menefee Foundry Co., Fort Wayne, Indiana:—A practical demonstration of the use of "Menco" in making pattern mounts for use on Roll Over Draw Moulding Machines.

Represented by James William Menefee, Earl H. Menefee.

Metal Industry, New York, N. Y.:—Trade publications.

Represented by G. W. Cooper, Adolph Bregman.

Metal & Thermit Corporation, New York, N. Y.:—Metals and Alloys produced by the Thermit Process, also samples and pictures of Thermit Welding.

Represented by Arthur F. Braid, J. M. Wilson.

Michigan Smelting & Refining Co., Detroit, Michigan:—Brass and Bronze Ingots and Billets, Wire, Bar and Powdered Solders, Lead and Tin Pipe, Babbitt Metals, Brazing Spelter, Die Castings, Special Alloys, Tin-Lead, Copper, Spelter, Antimony, Aluminum.

Represented by John R. Searles, Henry Levitt, Norman Sillman, R. R. Arnold, B. P. Cooke, C. L. Hall, James P. Tiernan.

Mills, Rhines, Bellman & Nordhoff, Toledo, Ohio:—Photographs, drawings, layouts and complete plans of modern industrial plants, including foundries, machine shops and forge shops.

Represented by George S. Mills, George V. Rhines, John Gillett, Morris Hobbs.

Moline Iron Works, Moline, Ill.:—Moline Hand Squeezer Molding Machine, patented, built in three types.

Represented by B. V. Nutt.

Monarch Engineering & Manufacturing Co., Baltimore, Maryland:—Melting furnaces, with and without Crucibles, for melting ferrous and non-ferrous metals, Core Ovens, Ladle Heaters, etc.

Represented by William Raber, Lees Hall, H. D. Harvey, James V. Martin, Frank Maujean, H. N. Schreuder, I. D. Adams.

National Engineering Co., Chicago, Ill.:—Simpson Sand Mixers, three sizes, used for the preparation of facing sand and core sand and other foundry sand mixtures, in operation.

Represented by H. S. Simpson S. H. Cleland, C. J. Skeffington, Barney Castor.

National Sale Co., Chicopee Falls, Mass.:—Counting and weighing machines, elevating trucks, adjustable steel shelving, and calling system.

Wm. H. Nicholls Co., Brooklyn, N. Y.:—Molding Machines.

Represented by Wm. H. Nicholls, George Karl, H. P. Mackinson.

Norma Company of America, Long Island City, N. Y.:—Norma Precision Ball Bearings, Hoffman Roller Journal Bearings, and Ball Thrust Bearings.

Represented by F. W. Meisinger, R. E. Hecker.

Northern Blower Co., Cleveland, Ohio.:—Steel Case Dust Collector, Sand Blast Room, also Cyclone, Exhaust Fan, Emery Stands and Piping, all miniature size.

Represented by M. A. Eiben, E. J. Moore, R. J. Emerich.

S. Obermayer Company, Chicago, Ill.:—Esso Hott Hatch Furnace Cements, Dry and Plastic Peerless Parting Compound, Vibrators—Pneumatic and Elastic.

Represented by Theodore Kauffmann, S. T. Johnston, E. D. Frohman, H. D. Barker, J. E. Evans, W. C. Samuels, J. L. Cummings, H. E. Beckman, Wm. Lawson.

Ohio Body & Blower Co., Cleveland, Ohio:—Swartout Single Unit Rack Oven, Rack and Elevating Truck and Portable Shelf Type Oven.

George Oldham & Son Co., Baltimore, Maryland:— Complete line of Pneumatic Floor and Bench Rammers, Clipping Hammers, Scaling Tools, Core Busters, Riveting Hammers, and Accessories.

Represented by Robert W. Nelson, H. T. Bannister, Joseph T. Biles, P. Woolfolk.

Oliver Machinery Co., Grand Rapids, Mich.:—Pattern Shop Equipment, Woodworking Machinery, Portable Motor Driven Machinery, Pattern Shop Supplies.

Represented by A. S. Kurkjian, Arthur Blake, J. E. McLauchlin, J. R. Duthie, C. A. Ginter.

Osborn Mfg. Co., Cleveland Ohio:—Roll Over Jolt Machine with electrically operated Roll Over and Pattern Draw. Flask Filling Machine for handling sand. Jolt Squeezer Machine, Plain Air Squeezer Machine, Hand Operated Roll Over, Jolt Stripper Squeezer Machine, Hand Operated Stripping Machine.

Represented by Franklin G. Smith, H. R. Atwater, E. S. Carman, E. T. Doddridge, J. C. Alberts, R. E. Kiefer, F. T. Spikerman, H. E. Deakins, M. R. Atwater, George Sawitzke, R. W. Hisey, E. F. Opster, E. E. Arnold.

Oxweld Acetylene Company, Newark, N. J.:—Oxy-acetylene welding and cutting apparatus and supplies, Low Pressure, Duplex type Acetylene Generator and Oxygen Manifold, in operation.

Represented by J. N. Walker, L. D. Burnett, Mark Wade, G. R. Mitchell, A. E. Dittrich.

Pangborn Corporation, Hagerstown, Maryland:—Complete line of Sand-Blast and Allie Equipment, specimens of Sand-Blasted castings and abrasives.

Represented by Thomas W. Pangborn, H. D. Gates, R J. Potter, F. J. Hull, John C. Pangborn, George A. Cooley, Jesse J. Bowen, Rop C. Koch, W. C. Lytle, Charles T. Bird, L. E. Nelson.

J. W. Paxson Co., Philadelphia, Pa.:—Various foundry sands for molding and core making. Supplies and equipment.

Represented by H. M. Bougher, J. F. Goehring, C. B. Somers.

Penton Publishing Co., Cleveland, Ohio:—Books and periodicals dealing with foundry work.

Represented by John A. Penton, A. O. Backert, D. M. Avey, H. E. Diller, Pat Dwyer, Charles Vickers, C. J. Stark, E. L. Shaner, D. O. Taber, F. V. Cole, J. D. Pease, S. H. Jasper, J. F. Ahrens, J. B. Howarth, H. W. Collart.

Charles Pettinos, New York, N. Y.:—Graphite, Plumbago, Foundry Facings, Blackings, etc., Molding and Foundry Sands of all kinds, Foundry Supplies.

Represented by Charles E. Pettinos, Marshall M. Housekeeper, J. H. Bing.

George F. Pettinos, Philadelphia, Pa.:—Moulding and Core Sands and Gravel, Foundry Facings and Blackings, Graphite, Amorphous, and Crystalline.

Represented by George F. Pettinos, H. B. Taylor Jr., James H. Hatten, H. I. Graves, Alexander Haigh, Donald S. Yeomans, Thomas H. Walker.

Pickands, Brown & Company, Chicago, Ill.:—Appropriate Exhibit of Solvay Foundry Coke.

Represented by G. A. T. Long, Robert S. Dutton, F. L. Schulze.

Pittsburgh Electric Furnace Corp., Pittsburgh, Pa.:—Photographs of furnace installations, together with some castings made in the furnace as well as a supply of literature for distribution.

Represented by W. B. Wallis, Jas. L. Cawthon Jr., W. E. Moore, H. E. Bromer.

Porcelain Enamel & Manufacturing Co., Baltimore, Maryland:—Porcelain Enameling with PEMCO Enamels by the PEMCO PROCESS.

Represented by Heinrich Turk, Karl Turk, Frank G. Roberts.

Portage Silica Company, Youngstown, Ohio:—Conglomerate silica rock in its natural state; samples of various grades of Sand Blast, Steel Molding, and Core Sands.

Represented by E. E. Klooz and L. R. Farrell, C. F. Eberhart.

Henry E. Pridmore, Inc., Chicago, Ill.:—Combination Electric Jolt Power Rock-Over Machine, Combination Electric Jolt Hand Strip Machine, Rock-Over Drop and Square Stand Machines.

Represented by Mrs. Henry E. Pridmore, Henry A. Pridmore, Marshall E. Pridmore, D. F. Eagan, C. H. Ellis, H. G. Schlichter.

Racine Tool & Machine Co., Racine, Wis.:—"RACINE" High Speed Metal Cutting Machines, Automatic Broach-Slotter and Keyseater, and High Speed Portable Rail Cutting Machine.

Represented by M. E. Erskine, Mrs. M. E. Erskine, Thos. A. Hyde, Wm. Reinhardt.

Richards-Wilcox Manufacturing Co., Aurora, Ill.:—Overway conveying equipment, trolley and I-Beam types, cranes, switches, cross overs, trolleys, and hoists.

Represented by W. H. Fitch, A. J. Eggleston, E. J. G. Phillips, W. O'Brien, R. F. Murphy, H. R. Butler.

Rogers, Brown & Company, Cincinnati, Ohio:—Electrically operated map showing location of sources from which products are shipped.

Represented by R. W. Clark, Geo. R. Sullivan, H. W. Fernald, Thos. A. Wilson, Harwood Wilson, A. F. Stengel, W. R. Maher, F. W. Bauer, J. R. Morehead.

P. H. & F. M. Roots Co., Connersville, Indiana:—Roots Positive Displacement Blowers, Charging Hoists, and Flask Guides, and Wind Gates.

Represented by H. M. Papworth, W. H. Morgan, D. R. Schively, E. A. Overhiser, Mr. Snyder, Paul Diver, Louis Oakley.

Royer Foundry & Machine Co., Wilkes-Barre, Pa.:—Demonstration of Royer Sand Separator and Blender.

Represented by G. F. Royer and W. M. Williams.

Sabin Machine Co., Cleveland, Ohio:—Sabin One-man Factory Trucks and Open top steel barrels, both straight side and tapered side, for nesting.

Represented by H. B. Sabin, O. C. Sabin, A. E. Dorod.

Safety Equipment Service Co., Cleveland, Ohio:—Safety Equipment and Supplies, Safety Clothing, Gloves, Leggings, Hoods and Helmets, Goggles, Respirators, Safety Signs, First Aid Supplies, Safety Guards and Appliances.

Represented by Buell W. Nutt and H. L. Wood.

Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.:—The Shepard Electric Liftabout. This is a universal electric hoist adapted for use in every class of industry. Ideally suited to the foundry trade.

Simonds Manufacturing Co., Fitchburg, Mass.:—Solid and Inserted Tooth Metal Cutting Saws in operation, Slitting Saws, Slotting Saws, Hack Saw Blades, Files, Metal Cutting Band Saw Blades.

Represented by H. B. McDonald, H. D. Horton, R. D. Baldwin, Tom Welch.

Skinner Brothers Manufacturing Co., Inc., St. Louis, Missouri:—Heating Equipment, Steam-Baetz Patent Air Heaters, Direct Fired Skinner, Baetz Tempering Ventilator.

Represented by E. V. D. Wallace, Merrill G. Skinner, Henry Baetz.

W. W. Sly Manufacturing Co., Cleveland, Ohio:—Steel Core Oven, Sandblast Equipment, Tumbling Mills, Dust Arresters.

Represented by S. C. Vessy, F. W. Klatt, F. A. Ebeling, M. M. Lowrie, D. L. Harris, J. L. Battenfeld, R. S. Evans.

Werner G. Smith Company, Cleveland, Ohio:—Core Oils and specimen cores made with their oils by prominent foundries, specimen castings.

Represented by Werner G. Smith, Milton S. Findley, Frank H. Grace, Frank H. Dodge, L. P. Robinson, Wm. E. Rayel, E. H. Heartlein, Louis F. Ferster.

Smith, Fassett & Co., N. Tonawanda, N. Y.:—Pattern and flask lumber.

Spencer Turbine Co., Hartford, Conn.:—Spencer Turbo Compressors for blowing gray iron cupolas and for use with oil and gas burning brass melting furnaces.

Represented by S. E. Phillips, H. M. Grossman.

Sterling Wheelbarrow Company, West Allis, Wisconsin: — Wheelbarrows and foundry flasks, wheel testing machine consisting of a wheelbarrow loaded with a 700 lb. load driven by power over a rough iron pulley at the rate of 30 revolutions per minute, to show the extreme strength of the Sterling Wheel.

Represented by H. H. Baker, George H. Lambkin, L. E. Washer, J. M. Dickson, H. J. Felsburg, J. J. Coyne.

W. F. Stodder, Syracuse, N. Y.:—Cyclone Suction Sand Blast.

Represented by W. F. Stodder.

Stoney Foundry Engineering & Equipment Company, Cleveland, Ohio:—Actual molding of automobile cylinders on jar squeeze strip machine and shaking out of sand by special apparatus.

Represented by J. T. Stoney, R. E. Stoney, K. Purwin, E. S. Cohen.

N. A. Strand Co., Chicago, Ill.:—Flexible Shaft Grinding Machines, Motor Drive.

Represented by P. P. Hubbard.

Sullivan Machinery Co., Chicago, Ill.:—Sullivan Angle Compound Compressor operating to supply exhibitors with air power; WG-6 10x10 Compressor,

C. E. HOYT
Re-elected Secretary-Treasurer

idle; Utility Forge Hammer in operation, and Sullivan Core Breakers.

Represented by Chester G. Cummings, Alden L. Covill, Alex Milne.

Wm. Summerhays & Sons, Rochester, N. Y.:—Photographs of Radial Brick Chimneys and Boiler Masonry Display of Refractory materials.

Represented by Wm. W. Summerhays, J. E. Summerhays, L. J. Summerhays, C. J. Newman, H. F. Miller, Frank Lowrey.

Superior Sand Co., Cleveland, Ohio:—Molding Sands.

Represented by W. H. Smith, H. C. Koontz.

Syracuse Industrial Gas Co., Syracuse, N. Y.:—Pan blowers.

Syracuse Supply Company, Syracuse N. Y.:—Radial drills, tool room and high duty lathes, shapers, manufacturing lathes and high speed drill presses in operation.

Represented by J. C. Hussey, H. W. Schatz, F. L. Stubenroth, J. A. Camm, J. Schmidt, J. Edlund, W. A. Ridings, W. H. Birdsall, F. B. Scott, Jr., H. Prigoff, C. L. Reasel, H. D. Mozeen.

Tabor Manufacturing Co., Philadelphia, Pa.:—Complete line of Molding Machines, including Squeezers, Jar Squeezers, Jar Strippers, Split Pattern Machines and Jar Rollers.

Represented by Wilfred Lewis, H. W. Brown, J. T. Ramsden, H. W. Impey, E. S. Lewis, John Fender, W. E. Sewell, J. H. Coleman, T. L. Sumner, P. J. Shire.

Taylor Instrument Companies:—Rochester, N. Y.:—Electrical Pyrometers, Indicating Thermometers, Recording Thermometers.

Represented by H. B. Brown, G. A. Howell, A. A. Sandy, J. J. Kimmel, J. W. Schwarz, C. B. Carson.

W. P. Taylor Co., Buffalo, N. Y.:—Small high grade Electric Steel Castings of various types, finished and unfinished.

Represented by Clarence D. Taylor, James W. Gibney, William J. Gibney.

R. J. Teetor Co., Cadillac, Mich.:—Howe-Teetor Model 9 Full Portable Molding Machine. Howe-Teetor Model 9 Stationary Squeezer; Convertible to Portable Type.

Represented by R. J. Teetor, C. W. Eyke.

Truscon Steel Company, Youngstown, Ohio:—Foundry Flask Equipment, Core Trays, Core Boxes and Core Plates; Mold Jackets, Snap Flasks, Snap Flask Bands, Bottom Boards, Steel Platforms and Boxes for Lift Trucks; Truscon Standard Building, Steel Sash, Hy-Rib and Metal Lath, Steel Joints. Reinforcing of all kinds. Technical Paints.

Represented by G. F. Sparks, N. C. Ferreri, W. B. Jones, P. A. Nuttall, G. E. Snedeker, J. C. Pierce, F. F. Griswold, H. W. Jencks, G. E. Madden, J. A. Morrissey.

United Compound Company, Buffalo, N. Y.:—Buffalo Brand Vent Wax, for core-venting, Buffalo Brand Pattern Wax, and Buffalo Corrugated Gaggers.

Represented by L. F. Leney and W. F. Bradley.

United States Graphite Co., Saginaw, Mich.:—Plumbagos and Foundry Facings manufactured from Pure Natural Amorphous Graphite, and other Graphite products.

Represented by G. D. Robinson, R. J. Edmiston, C. D. McIntosh.

United States Silica Company, Chicago, Ill.:—Flint Shot and Flint Silica, samples of castings that have been sand blasted with Flint Shot.

Represented by Volney Foster, Lewis B. Reed, H. F. Goebig, T. S. Rogers.

Vibrating Machinery Co., Inc., Chicago, Ill.:—"Sandhog" Electric Sand Sifter, with new steel Riddle and interchangeable screens. "Twin-Sand-Hog" Electric Sand Sifter, with two superimposed screens and automatic discharge of tailings. New Motors and Malleable Iron Frames.

Represented by J. Schroeter, Arthur Piepjohn, Wm. Lindsay.

Wadsworth Core Machine & Equipment Co., Akron, Ohio:—Wadsworth Core Cutting Off and Coning Machine, and Wadsworth Steel Core and Bottom Plates.

Represented by M. C. Sammons, L. I. Crane.

H. L. Wadsworth, Cleveland, Ohio:—Motion Pictures showing various sizes of Wadsworth Sand Cutter in operation, with details of construction.

Represented by H. L. Wadsworth, K. W. Benham, K. S. Darrow, E. S. Weidle, E. L. Smith, W. H. Wadsworth, M. Z. Williams.

J. D. Wallace & Co., Chicago, Ill.:—Wallace Bench Planer, Jointer, Universal and Plain Saws and new 16" Band Saw. Wallace Bench Glue Pot with automatic control which keeps glue at 150 degrees constantly.

Represented by J. D. Wallace, H. L. Ramsay, James F. Stewart, C. J. Rennie, A. N. Frecker, Wm. Uhlhorn, A. M. Andresen, F. W. Andresen, C. E. Ward, E. G. Russ, C. H. Landis.

Wayne Tank and Pump Company, Fort Wayne, Indiana:—Metal Melting Furnace, Ladle Heater, Portable Wheel Tank for Core Oil, Fuel Oil Burners, Gas Burners, Automatic Interlocking Cut-Off Valve for Fuel Oil.

Represented by R. P. Maynard.

Westinghouse Electric & Mfg Co., East Pittsburgh, Pa.:—175 ampere portable arc welding set, with operator making typical welds. Typical alternating current and direct current automatic control and also typical industrial motors.

Represented by A. D. Turner, W. W. Reddie, Paul Orr, H. E. Dralle.

Westinghouse Traction Brake Company, Pittsburgh, Pa.:—Westinghouse-National Operative Automatic Air Compressor; also Reservoir, Operating Valves, Air Cooks, etc.

Represented by M. H. Burchard, O. H. Miller, J. F. Ames, F. C. Young, S. A. King.

Weyerhaeuser Sales Co., Chicago, Ill.:—Pattern and flask lumber.

White & Bro., Inc., Philadelphia, Pa.:—Certificate Metals in their entirety, comprising Composition and Yellow Ingot Brass, Marine Brand Manganese, C. C. Brand of Casting Copper, and White Metals.

Represented by Clarence B. White, Frank Krug, Raymond Hunter, G. Horace Krider, L. D. Kluver, Harold Reinhardt.

Whitehead Brothers Company, Buffalo—New York—Providence:—Samples of Moulding Sand and Castings.

Represented by A. J. Miller, V. L. Whitehead, Jr., J. H. Whitehead, C. E. Andrews, R. L. Cleland, A. W. Jacus, R. L. Carpenter, R. J. Hashagen, T. F. Hogan, A. Y. Gregory, Mr. Clarke.

Whiting Corporation, Harvey, Illinois:—Sand Cutting and Screening Machine, Helical-Worm Geared Crane Ladle and set of Helical-Worm Ladle Gearing with section cut away to show interior; Tumbling Barrel Parts, Model of Crane Trolley, photographs, drawings, catalogs, etc. Also vertical Air Hoist.

Represented by J. H. Whiting, T. S. Hammond, R. H. Bourne, R. E. Prussing, J. S. Townsend, G. P. Fisher, A. W. Gregg, C. H. Erickson, W. A. Goebel.

T. B. Wood's Sons Company, Chambersburg, Pa.:—Equipment for the Wood System of Taper Snap Molding, comprising the Peerless Patented Tapered Snap Flask and Automatic Adjustable Patented Snap Jacket.

Represented by Charles M. Wood, Victor Leisher, George Leisher, John T. Hoover, C. J. Zullinger.

E. J. Woodison Company, Detroit, Mich.:—Core and molding machines, foundry supplies, platers' and polishers' supplies.

Represented by E. J. Woodison, C. H. Woodison, J. C. Woodison, George A. Burman, A. W. Ferguson, A. F. Jordan, W. J. Wark, R. S. Hoffman, H. Z. Dinge, M. A. Bell, C. F. Witters, E A Mead, J. A. Carpenter, F. F. Shortsleeves, C. D. Pinkerton, Ray Higgins, George Quinn, Wm. Muir, J. Jerosky, W. W. Wright, R. A. Burritt, George Donoghue, H. T. Taylor, W. W. Bowring, E. C. Schafer, Wm. Maybank.

Wright-Hibbard Industrial Electric Truck Co., Inc., Phelps, N. Y.:—Industrial Trucks and Tractors.

Represented by R. F. Hibbard, V. Minet.

Young Brothers Company, Detroit, Mich.:—Insulated Steel Panel Oven, designed for heating by Gas, Oil or Coke. A small testing or laboratory electrically heated oven and accessories. Samples of cores in their ovens.

Repfesented by Geo. A. Young, Robt. B. Reed, Thos. P. McVicker, V. A. Fox, J. E. Randall, E. F. Oates.

The Buildings

The building and grounds were admirably suited for the purpose. The three buildings which were connected being used for the exhibits while the dining hall and the auditorium were situated at some distance, thereby allowing those who wished to dine, and those who were reading papers or listening to them being read, to do so in peace and quietness free from the noise and turmoil of the jolt-ram-squeeze-roll over-pattern-drawing machines which seemed to vie with each other in seeing which could create the most businesslike impression on the visitor and prospective purchaser.

While the various machines in operation were eye-openers, the papers which were being read and discussed gave the listener much added knowledge to that which he received while viewing the exhibition.

Some of the papers which were read and some of the machines in operation will form the chief topics in the present issue of this publication.

The Banquet

The banquet at the Powers Hotel Wednesday evening was, as usual, one of the features looked forward to with anxious expectations on account of the addresses which invariably follow, and was fully up to the mark, being well attended and enjoyed. Between the courses the banqueters were treated to selections from the orchestra and vocal selections from singers of both sexes. After the appetite had been thoroughly satisfied, the guests were treated to an interesting programme from the platform. Owing to the unfortunate sickness of President Bean, necessitating his absence from the convention, C. R. Messenger, vice-president, acted as chairman and by request of Mr. Bean who is a former Rochesterite, his old friend and colleague Roland B. Woodward, secretary of the Rochester Chamber of Commerce acted the part of toastmaster.

The first speaker was E. J. Cook of West Birmingham, England, past president of the Institute of British Foundrymen. In his address he pointed out many mistaken views which Americans have of British policy; he explained the part British workmen took in the war; how his company provided for the dependents of those of their employees who joined the army and how their positions were held for those who were fortunate enough to return. He also explained the misconception of Americans who complain of John Bull endeavoring to "hog" the markets of the world. He explained that while America was self sustaining and might live without the rest of the world, Great Britain had to spend her money in purchasing foodstuffs from such countries as the United States and unless she could export sixty per cent. of her manufactured goods she could not possibly carry on and would have to go under. America was urged to consider this and not look upon Great Britain as an avaricious country seeking more than its share.

The next speaker was Governor Henry J. Allen of Kansas, who spoke of the success which his state had had in dealing with industrial disputes. His talk was mainly an exposition of the principle that the safety of the public is the supreme law of the land to be respected over the quarrels of capital and labor. He told of the formation and results of the Kansas Court of Industrial Relations, brought into being two years ago to protect the public from cessation of operation either through lockout of the employers or strike of the workers of the essential industries of fuel, food, clothing and transportation. He says Kansas refuses to be tied up and that if trouble is brewing the court settles it and all parties must abide by the decision. He argues that the court does not expect a man to work for a living wage but that he must have a living wage plus enough to support and educate his family and also have some to put by in case of sickness or necessities of any kind. The court insists on this being paid by the employer whether he likes it or not, and it also insists that the workman either accept it or go about his business, but if he quits either by himself or in company with a number of others he must not interfere with those who remain at work. Anyone who breaks this law, either employer or employee is a criminal just the same as though he had broken any other law, and is dealt with accordingly.

The third speaker was Larry Sharkey the Irish senator who kept the audience in uproars of laughter at his true Irish wit and humor.

The Excursion

The trip on the lake Thursday afternoon was, by many, considered the best feature of any. To those who live inland a boat ride is not an every day occurrence, and is welcomed as a real treat. M. H. G. Hetzler of the North West Foundries, who was chairman of the entertainment committee had arranged an interesting programme for this trip which was carried out without a hitch. The American Legion Band of Rochester under the leadership of Mr. Victor Lindboe was situated on the upper deck and disbursed sweet music during the entire afternoon and evening, the later of which was taken advantage of for the purpose of dancing. On the second deck a first-class vaudeville entertainment took place under the leadership of Charles E. Hawker. A leading feature of this was a pugilistic combat between Walter and Earl Gunn, vintages of 1912 and 1914. The uppercuts, left swings and clinches were executed in a marvellously clever manner but the judges were unable to render a decision as to the winner for fear of offending one of the contending parties. The remainder of the programme was mainly musical, Miss Myrtle Stephany's orchestra furnishing the music.

The Programme

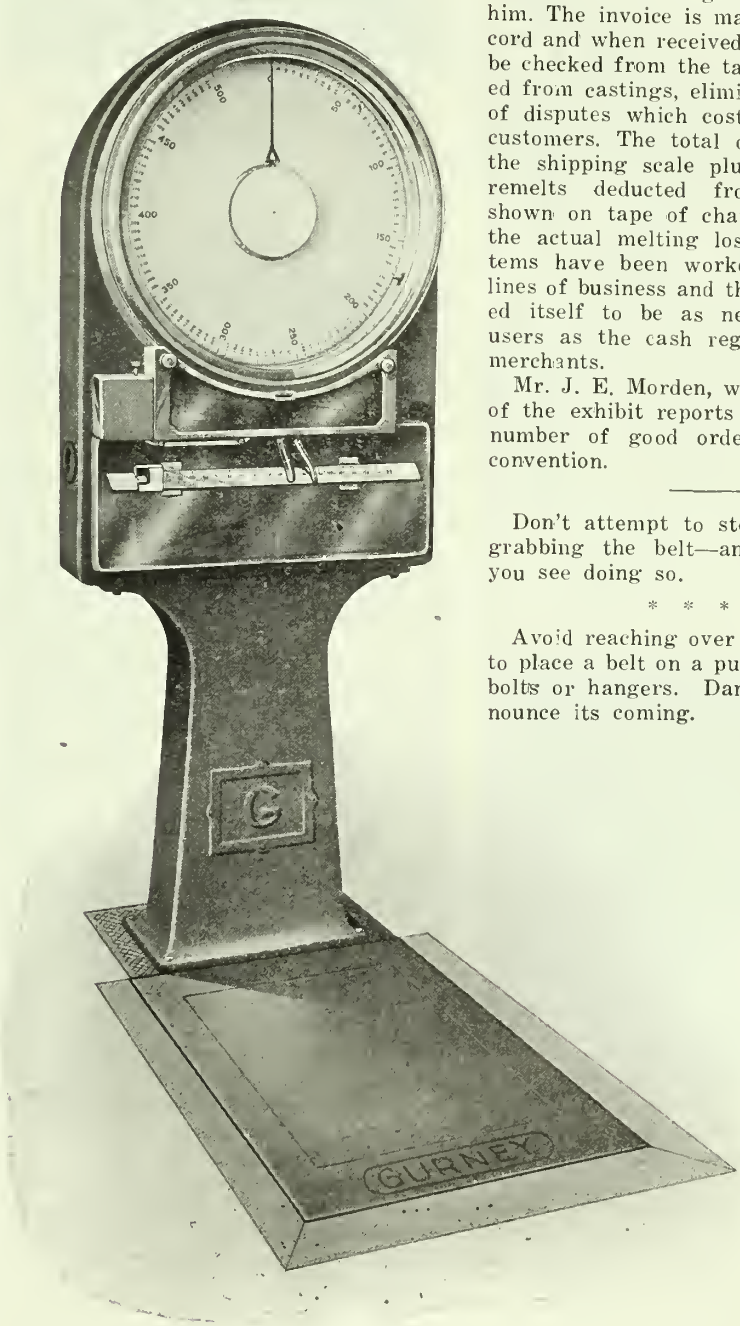
The programme, in addition to the number just mentioned was as follows: Nicholas Pagliara, tenor solo; Frank Clark, talkative banjo solo; Jim Cullan, baritone solo; Nina Smylie putting over songs; Hawkins Twins, "Wabash Blues" duet; Sam Kelman, Jewish comedian; George Schumacher, big tenor from North West Foundries; Alice Davin, soprano supreme; Doyle and Wagner, a little bit of nonsense; Walter Harvey, baritone solo; Marie Spillane, contralto solo; Rochester Four Quartette, selections; Ray Hogan, card shark; Surprise Act (?); Charles Hawkins and Elroy Miller. These numbers were all encored, some a couple of times, while interspersed between the numbers and for a considerable time after the programme was completed dancing was in progress on this deck, during all of which time the charming Miss Stephany, who, by the way, is the recognized champion of the key board in the Rochester district, and her faithful band of artists kept the air constantly filled with delightful music. Towards midnight the steamer tied up at the dock and the crowd dispersed well pleased with their ten hours' cruise.

Officers for the Ensuing Year

Following the usual custom the vice-president of the past year was elected by acclamation as president for the coming year. All the other positions were likewise filled without any contest. The officers as they now stand are C. R. Messinger, of the Chain Belt Company, Milwaukee, president; G. H. Clamer, of the Ajax Metal Company, Philadelphia, vice-president; C. E. Hoyt, Chicago, secretary and treasurer; directors for three years, C. B. Connelley, head of the Pennsylvania Department of Labor and Industry; Fred Erb, of the Packard Motor Car Company, Detroit; L. W. Olson, of the Ohio Brass Company, Mansfield, Ohio; C. E. Hoyt, Chicago and A. B. Root, jr.

No decision has yet been arrived at regarding probable location of the next convention. but all are agreed that under no consideration can another year be allowed to pass without a convention. It was also pretty well agreed upon that June is the proper month for such gatherings.

A fact which all Canadians will be proud of is that Canada had at least one exhibitor at the Foundrymen's Convention at Rochester, N. Y. The Gurney Scale Company of Hamilton, Ont., exhibited their type registering and recording dial scale and were the only Canadian manufacturers making a display there. Great interest was shown in this the latest and newest development in the scale industry. For many years there has been a demand for a recording dial scale, but until the Gurney was put on the market some two years ago the nearest approach was the type registering beam used on railroad track, grain elevator, and motor truck scales. The beam merely embossed a ticket and provided no record and thus fell short of what was required. Another drawback was that it could only be made to emboss in large divisions namely 5, 10 or 20 pounds. The new scale prints in one and two pound divisions, a tape record is made simultaneously with the ticket printing (actually printed from a typewriter ribbon) regular systems are worked out with the use of this device. In the foundry business used as a charging scale the classification letters on the dial in the form of the alphabet are used to designate the materials going into the heat, for instances A represents No. 1 pig, B No. 2 pig, C stove scrap, D coke, etc., thus furnishing a complete analysis of the metal poured. The tape is removed daily, dated and filed for reference. Before doing this, however, amounts of various materials are entered on cards and these deducted from previous figures make a perpetual inventory of materials on hand. The totals of all materials are taken and entered on a card for the purpose of determining heat loss or shrinkage.



The Garney Type Registering and Recording Dial Scale.

As a shipping scale the alphabet is made to represent the customers—A-Jones, B-Smith, C-Brown, etc. Tags are printed with the tape which are wired on each casting or group of castings. These tags form a checking basis for customer as castings are received by him. The invoice is made from tape record and when received by customer can be checked from the tags he has received from castings, eliminating all chance of disputes which cost foundries many customers. The total of the tags from the shipping scale plus the amount of remelts deducted from the amount shown on tape of charging scale gives the actual melting loss. Complete systems have been worked out for other lines of business and the scale has proved itself to be as necessary to scale users as the cash register is to retail merchants.

Mr. J. E. Morden, who was in charge of the exhibit reports that he placed a number of good orders while at the convention.

Don't attempt to stop a machine by grabbing the belt—and caution others you see doing so.

* * * *

Avoid reaching over a revolving shaft to place a belt on a pulley, or to tighten bolts or hangers. Danger does not announce its coming.

American Versus British Grey Cast Iron

Superior Qualities of British Iron Shown—Sulphur and Phosphorus Not as Detrimental as Generally Believed—Soft Castings Depreciate Value of American Machinery

By F. J. COOK.

"This paper is one of a series on foundry problems being exchanged between the Institution of British Foundrymen and the American Foundrymens' Association. The first, prepared by Geo. K. Elliott of the American Foundrymens' Association, was presented at the 1921 meeting of the Institution of British Foundrymen. The author of the accompanying paper, F. J. Cook, is one of the outstanding figures in the British foundry industry. He is a past president of the Institution of British Foundrymen, and is manager of Rudge-Littley, Ltd., West Bromwich, near Birmingham.

RIGHTLY or wrongly, the average British engineer and foundryman considers that American gray cast irons of their respective class are inferior in physical properties to those of Great Britain. He bases this opinion, first of all, upon the undoubtedly poor wearing qualities of the cast iron which some years ago formed the material of the large quantities of machine tools sent to England. It was commonly said that the cast iron was so soft as to be easily cut with a pocket-knife, a statement often enough literally correct.

Recently, some improvement has been noticed, attributed to wider bearing surfaces and the application of chills on wearing parts, combined with the use of semisteel. Nevertheless experiences are still related, in connection with the war, showing that American material frequently left a good deal to be desired. The author was familiar with an American machine supplied by a well-known maker which was commandeered by the government for a special operation in connection with parts for large guns. Owing to the poor quality of the cast iron the machine was constantly breaking down. No fault could be found with the design which was excellent for its specilfic requirement; yet owing to the long periods when it was out of commission through breakdowns the output was less than that obtained from an improvised old machine. It was necessary to replace the broken parts with castings produced from local irons, utilizing the broken portions for patterns. These substituted parts proved quite satisfactory, and there was some foundation for the statement, although not strictly and literally true, that the only part remaining of the original cast iron in the machine at the end of the war was the name plate on the bed.

Writers of scientific papers in America frequently refer to the failure of cast iron parts under superheated steam. This is a state of affairs very unusual in this country, gray iron castings being made here without difficulty sufficiently strong to withstand working temperatures and pressures quite equal to those under which American castings have broken down. The composition of this more durable material is not widely different from the American irons which have proved unsuitable.

Some years ago an American technical journal with which the author was familiar regularly gave reports of burst fly-wheels, until at last it became quite natural to look for them with very much the same amused interest as the readers of "Punch" anticipated the historical cartoon. English engineers regularly engaged in designing cast iron flywheels up to a weight of 56,000 pounds having periphery speeds of not less than 100 feet per second sometimes wondered as to the character of the remarkable material of which the American wheels were made.

Travel naturally widens one's view and extends one's knowledge, and, conversely, there is a tendency on the part of the stay-at-home to become parochial and narrow. One of the results of the war has been a more frequent interchange of visits and we on this side from a period shortly before the end of the war received from many leading American foundrymen, whose eminence consists not only in foundry knowledge but in general accomplishments. We hope they will pardon the amusement we have derived from the very candid opinions they have expressed in regard to us and our institution in the old days before, like the Queen of Sheba, they came to see for themselves. One American, for example, expressed the belief that British foundries were generally so badly lighted that an electric torch was necessary to find one's way about in them; moreover the molding shops were so low that one had to be careful not to knock his head against the roof principals. He was candid enough to say that the first British molding shop he entered fairly took away his breath. After spending the whole afternoon in it he regretted his inability to stay longer and see more. He discovered that he had only seen a small part of the whole, and was a little surprised at the offer of his guide that "any time he had a week to spare they would be pleased to show him the remainder." As a matter of fact he was in the largest foundry in the world, and had no idea that so fine a concern could be found on this side of the Atlantic.

The author has to admit that up to the present he has been among the stay-at-homes and is quite prepared to find that his references to American practice will furnish foundrymen on the other side of the Atlantic with at least as much amusement as Britishers have derived from Amerincans and their opinion of Great Britain. The great purpose of the paper, however, is to furnish a basis for a good discussion and it may be hoped that this object will be realized.

As the subject of gray cast iron obviously is too wide to be dealt with in a single paper, it is proposed to limit its scope to the consideration of gray cast iron made from commercial pig irons, and cast iron scrap melted in a cupola by means of coke, and without the addition of steel or any ferrous or non-ferrous materials introduced either into the cupola or the ladle of molten metal.

When one comes to deal specfically with mechanical tests, the fact has to be faced that the conditions relating to mechanical tests for iron vary considerably in the two countries. Little importance appears to be attached in America to tensile testing, while the size of the transverse bars tested equally with the method of testing differs widely from British practice. The ruling tests for cast iron may be said to comprise in Great Britain: For pipes, constructional and general engineering work for more or less rough and large character, transverse bars, 2 inches deep, 1 inch thick and tested deep part down on centers 3 feet apart; for engine details other than cylinders, transverse bars 1 inch square tested on centers 12 inches apart. It is becoming more general in the finer classes of engine work to cast the transverse bars 1¼ inches square, marching down to 1 inch square to insure accuracy. For cylinders of all descriptions tensile bars are demanded, exactly of the same material as the castings they are to represent. Practically every tensile bar has to be tested in the presence of an inspector, and the casting of the bars on the job therefore, which might possibly arise if the bar was separately cast without the presence of the inspector. There is a great deal also to be said in favor of the tensile test for cylinders, since the castings themselves are necessarily subjected to tension. Moreover a tensile test gives a better indication of the wearing properties of this class of iron than any other test known to the author.

It may possibly be that the apathy with which the tensile test in America is regarded may to some extent be due to certain conditions named by Dr. Moldenke, though of that, of course, the author is not in a position to judge. Dr. Moldenke says:

"In this country (America) you will find about 99 out of 100 testing machines that are not in proper condition for the tensile test. On the other side they calibrate the machines often, and they have their governments to test them."

There can be no gainsaying his statement on the same page that "for scientifific investigation the tensile bar is preferable."

The reading of American scientific papers and of the technical press conveys the impression that a tensile test going a little beyond 31,360 pounds is considered worthy of special notice; certainly in this country anything like this would be considered quite mediocre. Mr. Ernest Wheeler, representing Messrs. Crossley Bros., Ltd., Manchester, states that he has found it "quite possible, without the aid of steel to prepare and obtain mixtures of cast iron having a tensile strength of over 18 tons (40,320 pounds) per square inch, and this is confirmed by other workers in the same field. The same gentleman has prepared for the author a bar cast in accordance with the specification for the "Arbitration bar" which has given a result of 39,200 pounds.

Table I

Results of Tensile Tests

Total carbon	C.C.	C.C.	P.	Analysis St.
3.054	0.98	2.074	0.974	1.213
3.054	0.84	2.214	1.046	1.166
3.3	0.89	2.410	1.140	1.40
3.163	0.665	2.498	1.186	1.40
3.272	0.84	2.432	0.981	1.143
3.21	0.72	2.49	1.2	1.49

S.	Mn.	Tensile test result lbs. per sq. inch	Transverse test equivalent, lbs. per sq. inch Arbitration Bar
0.146	0.324	32704	5146
0.136	0.432	32720	5146
0.134	0.453	36064	5146
0.136	0.465	39200	5373
0.137	0.288	41440	5562
0.126	0.420	44486	5600

A short time ago the author tabulated his average tensile test results over a working period of 500 consecutive days. The average figure was 36,288 pounds per square inch; no test was as low as 30,240 pounds, while the highest figure reached was 43,008 pounds. All the bars were 1¼ inches diameter and were cast on the castings they were to represent — not separate — and were turned down in the middle to ½-square inch area before testing. A typical range of tensile test results with this class of iron with the analysis is shown in Table I.

For mechanical tests to be strictly comparable it is essential that the bars should be of the same dimensions and similarily molded, gated, cast and tested. It may be argued therefore that the tensile test results given in Table I are not comparable to those obtained by the American arbitration bar. But the author suggests that in this respect

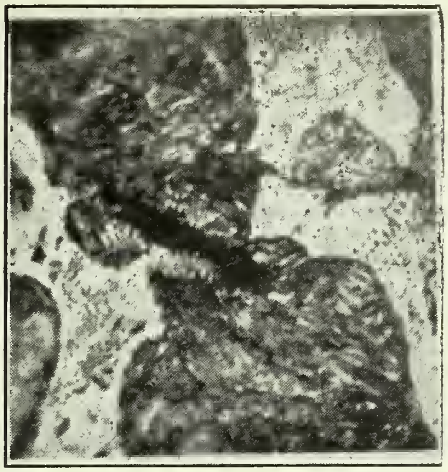


Fig. 1.—Gray Iron having a tensile strength of 41,216 pounds per square inch x 1,000

the advantage has not been with those cited. The bars were of the same dimensions as the arbitration bar, and they certainly had the advantage of static pressure due to casting head, as they are placed on the middle joint of short stroke cylinders. They have one disadvantage, however, in that they were cast with cooler metal than if they had been cast from a small ladle direct from a cupola, while the rate of cooling is slower, owing to their having been cooled down in close promixity to a larger body of metal. The disadvantages of all these conditions were well set out in the admirable exchange paper presented by George K. Elliott to the Institution of British Foundrymen last September.

Comparisons between the transverse tests made in the two countries are necessarily hampered by serious difficulties, chiefly on account of the difference in shape and dimensions of the bars used. The arbitration bar has a diameter of 1¼ inches and is tested as cast, on centres 12 inches apart. The bars with which the author is familiar and of which particulars are given later are cast 1¼ inches square, machined down to 1 inch square, tested on 12-inch centers, and cast on to castings, as previously defined in connection with the tensile test.

In the absence of an available machine suitable for taking a bar of 1¼ inches it has been necessary to evolve a constant which will reconcile the differences of dimensions in the two bars.

The results of the arbitration bar can be converted into those comparable for a 1-inch bar tested on the same center by multiplying the breaking load obtained by 0.74; conversely the result obtained on the 1-inch square bar divided by 0.74 will give the equivalent load on the arbitration bar. The formula used for obtaining this factor is given in the appendix to this paper.

In the discussion on Mr. Elliott's paper already referred to, the author gave some details of 25 transverse tests of bars giving an equivalent average breaking load on an arbitration bar of 5,300 pounds; the lowest bar gave an equivalent load of 5,146 pounds and the highest 5,600. The minimum load is a higher figure than that obtained by Mr. Elliott with American metal having a similar silicon content, but with lower phosphorus and sulphur after undergoing the refining action of an electric furnace.

Table I gives particulars of the transverse results brought up to an equivalent on the arbitration bar relative to bars cast on the same cylinders as those selected for tensile example.

Although the two previous tests are not in the strictest sense comparable, there is a mechanical test common to both countries, namely Keep's shrinkage and transverse test. The author was probably the first in Great Britain to have at his disposal a complete set of Keep's machines, and the present opportunity is gladly taken to acknowledge the great value of the shrinkage and transverse test in connection with this class of cast iron.

A rather lengthy correspondence took place with Mr. Keep relative to the working of the transverse machine with the ½-inch shrinkage bars. Mr. Keep expressed the opinion that the alignment of the machine had become affected during its transit. He arrived at this conclusion from the high results shown on the diagrams forwarded to him. In regard to these he said, "Probably we should not have a ½-inch square bar to break at over 425 pounds." Nothing could be found wrong with the machine

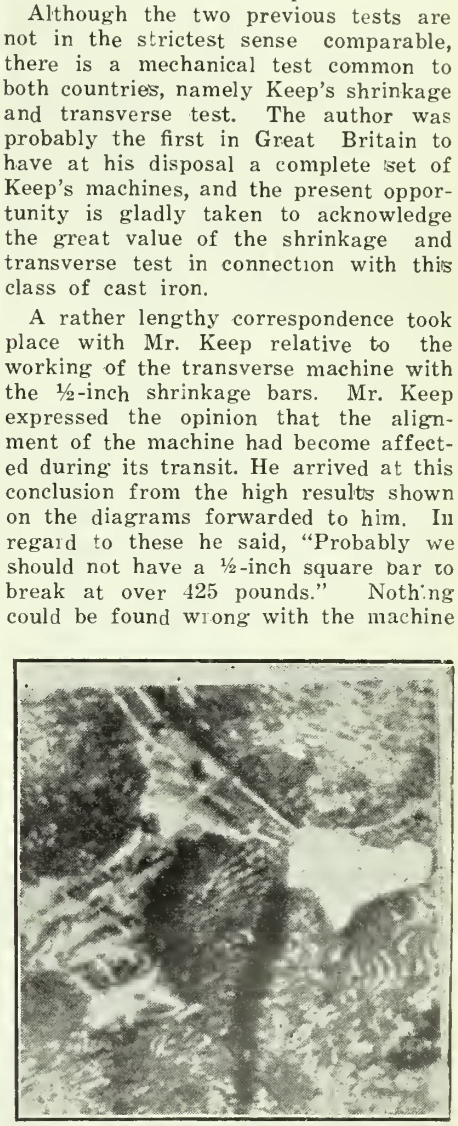


Fig. 2.—Gray Iron with tensile strength of 44,486 pounds per square inch x 1,000.

and as the results appeared to be borne out by other mechanical tests taken on bars of varying sizes from the same metal a few ½-inch bars were sent to Mr. Keep with a diagram of the corresponding bar in each set. The breaking loads varied from 590 to over 700 pounds. Mr. Keep replied as follows: "I did consider the high results obtained as due to your machine being out of order, but I was mistaken as my machine gives the same results. This iron is remarkably strong; I don't know of anything as good."

Table II
Keep's Tests

Shrinkage inches	Trans. Bk. Ld. in pounds	Deflec. inches
.146	550	.14
.161	600	.15
.157	650	.18
.158	675	.19
.159	700	.21
.161	800	.23

In Great Britain we consider Mr. Keep knows all about the mechanical tests that American irons will stand. The results shown in Table II of tests made with the same class of iron as those dealt with in Table I are not only typical of results obtained by the author but of those secured by other workers.

The general practice differs somewhat between the two countries in regard to the allowable percentage of the chemical elements in different classes of gray cast iron. This is undoubtedly due to prevailing differences in the irons and not to a lack of metallurgical knowledge.

With one or two notable exceptions, practical foundrymen in America appear to pay little attention to total carbon. While carbon receives special attention and is frequently mentioned it is only lately that total carbon has had due consideration. The quantity of combined carbon is important, but it is obvious that with varying amounts of total carbon the same percentage of combined carbon will have a different effect. Dr. Stead has shown examples in which increases of 0.1 per cent. of graphite have reduced transverse strength by 224 pounds and tensile strength to 1792 pounds per square inch.

Silicon receives a great amount of attention in American foundry practice and in conjunction with sulphur appears to be regarded as the Alpha and Omega by the purchasers of pig irons. One hears a great deal of "silicon control." In Great Britain silicon is merely considered with all the other elements entering into a commercial analysis. It must not be supposed that there is any lack of appreciation of the value of silicon, since in this city—the home of Professor Turner—it is probable that more research work has been done with regard to the influence of silicon than in any other centre. A formula which the author has used for many years with marked success in connection with the ratio of silicon to carbon in gray cast iron mixtures is as follows:

$$X = \frac{C}{4.26 - \frac{Si}{3.6}}$$

where X=the ratio of silicon to total carbon.

C=total carbon present.

Si=Silicon present.

X=0.9 to 1 for such work as pipes, grates, easily machined castings and general ordinary work.

X=0.83 for locomotive cylinders and castings requiring maximum transverse strength.

X=0.76 to 0.82 for steam, gas, oil and Diesel engine cylinders, and castings requiring maximum tensile strength.

X=0.75 to 0.8 for chilled castings.

X=0.85 for acid resisting castings.

British Foundrymen's Association, 1915.

What Is Effect Of Sulphur?

At one time in this country sulphur was considered the arch enemy of the ironfounder, although probably it is not taken quite so seriously as it is in America. In his exchange paper George K. Elliott considers that sulphur above 0.07 per cent. is dangerous. This does not agree with the results of Coe's research on British irons. Coe found that sulphur within limits of his work did not increase the brittleness of cast iron but appears to increase resistance to fracture.

In Table I the sulphur appears in a proportion twice the amount which Mr. Elliott considered dangerous, yet it does not appear to have prevented a high degree of strength being obtained. A liberal proportion, up to 0.12 per cent., has in the author's experience been found to have a beneficial effect upon the wearing properties of cylinders and liners subjected to heat conditions while no difficulty has been met with in the way of blow holes provided the metal has been melted and cast hot.

To an appreciable extent phosphorus is considered in America to be detrimental to the strength of gray cast iron. George K. Elliott in his paper states "Irons of greatest strength contain only a small amount of phosphorus." Dr. Moldenke in "Principles of Iron Founding" appears to put the limit for strong castings free from stains of 0.4 per cent. The author's experience points to the conclusion that with the strongest British irons the distribution of the phosphorus, provided the amount does not exceed 1 per cent., is more important than the actual quantity present. Phosphorus in a segregated form, the usual form in all weak irons, is dangerous where strengths are required, but provided it appears in the network or cellular form no detriment to strength is experienced with phosphorus up to 1 per cent. This form is assisted so long as the silicon and total carbon are restricted in the ratio appearing in the formula for strong irons.

Agreement appears to be more general in regard to the benefit derived from the poling action of manganese, but the author believes that manganese to the extent of 1 per cent. or over is detrimental to good wearing properties under heat conditions. This element has a way of developing spikey crystals which break off under rubbing and prevent the formation of that highly polished surface generally regarded as the distinguishing characteristic of all good wearing cast iron. Apparently, there

Fig. 3.—Gray Iron with Tensile strength of 20,384 pounds x 30. Graphitic carbon, 2.397; combined carbon 0.853; silicon, 1.328; sulphur, 0.095; phosphorus, 0.923; manganese 0.335.

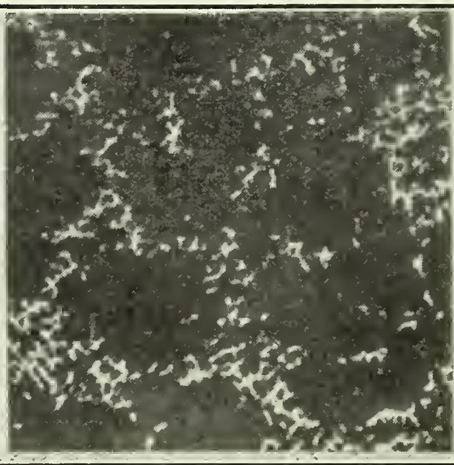


Fig. 4.—Gray Iron with tensile strength of 40,922 pounds x 30. Graphitic carbon, 2,289; combined carbon, 0.903; silicon, 1.314; sulphur, 0.101, phosphorus, 0.909; manganese 0.335.

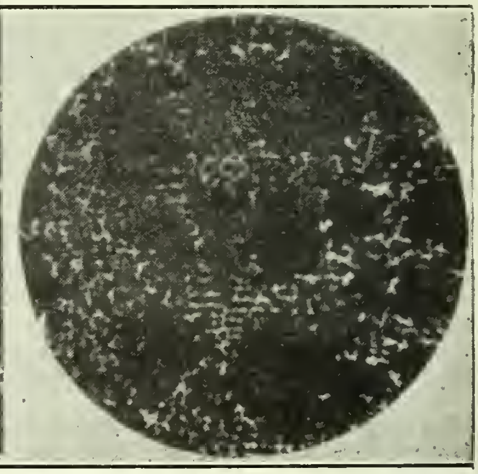


Fig. 5.—Gray Iron with tensile strength of 44,486 pounds x 30. Graphitic carbon, 2.49; combined carbon, 0.72; silicon, 1.49; sulphur, 0.126; phosphorus, 1.2; manganese, 0.420 per cent.

is much to be gained by keeping this element restricted to the proper proportion called for by the amount of sulphur; beyond this proportion there is a danger of the formation of manganese carbide.

Although chemical analysis necessarily forms the basis of all scientific work in regard to cast iron, unfortunately it does not follow that similar analyses necessarily involve similar physical properties. It is also admitted that strong gray cast irons are associated wth the matrix consisting of fairly large areas of well defined laminated pearlite, relatively stiff portions of cementite and small graphite, and these formations are illustrated by typical examples in Figs. 1 and 2.

While the microscope is a useful adjunct to chemical analysis the utility of the micrograph is limited; it being impossible to determine therefrom relative physical properties of specimens with mathematical precision, or to ascertain within narrow limits the relative variations. In all probability this is due to our imperfect knowledge of both subjects and it may be hoped that further research will clear up some of these matters.

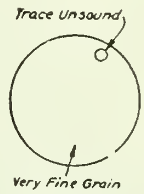
Occasionally, it is quite impossible in dealing with this class of iron to discover either by chemical analysis or the usual methods of microscopic examination great differences in physical properties. An interesting example of this took place some time ago. It was found that the highest tensile test obtained in 60 consecutive days' workings was lower than the lowest tensile test during the next 60 days. The metal was of similar chemical analysis but the mixture had been varied by introducing a different pig iron brand as one of the three constituting the charge. A research was carried out by the late George Hailstone and the author in connection with this class of investigation. All the methods usually employed for detecting the cause of difference in physical properties such as chemical analysis, high and low microscopic analysis and the employment of various etching agents failed to show any reasonable cause for the great difference which existed.

As a further test, specimens were deeply etched with 20 per cent. nitric acid in water as suggested by Stead and afterward re-examined under low magnification. It was then found that the strength of the material was directly related to the particular formation of the cementite and phosphide eutectic. The stronger the iron, the clearer were these two microscopic elements in the network as shown in Figs. 3, 4 and 5.

The author has made hundreds of examinations in order to test this and has never found a single example to the contrary. The network formation is apparent at about 26,880 pounds tensile strength and becomes more pronounced as the strength increases. In the author's view this method gives a surer approximation of the physical properties of the metal than any other form of metallography and is often superior to chemical analysis. It must be remembered, however, that the field under observation must be typical of the whole. In the illustrations given the micrographs are taken from the centre of the bar.

Table III

Chemical analysis	Tensile strength, pounds per square inch	Rotary fatigue test results: Revolutions per minute	Fiber stress tons per sq. in.	Total number revolutions to produce fracture	Appearance of fracture
T.C. 3.25%					
G.C. 2.397					
C.C. 0.853		980	5	10,000	Fracture sound
Si 1.328	20384	980	6	9,200	Slightly open
S. 0.95					
P. 0.923				19,200	Grained
Mg. 0.290					
T.C. 3.192					
G.C. 2.289		980	5	10,000	
		980	6	10,000	
C.C. 0.903		980	7	10,000	
		980	8	10,000	
		980	9	10,000	
Si. 1.314	40992	980	10	10,000	
S. 0.101		980	11	10,000	
		980	12	10,000	
P. 0.909		980	14	10,000	
		980	13	10,000	
Mg. 0.335		980	15	800	
				100,800	



In connection with the research already referred to, the authors as one of their conclusions decided that the temperature at which the pig iron is made in the blast furnace has a direct effect upon the formation of this network structure. At the time this statement aroused a great amount of criticism, one professor stating that after remelting the iron had forgotten all about the hole from which it had been dug. Time has since proved the inaccuracy of this view and it is now clear that the temperature of the blast furnace has a marked effect upon the physical properties of the metal, and that these are maintained after remelting.

One progressive blast furnace manager has found that pig iron having this network structure, after going through the puddling furnace, yields wrought iron with higher physical properties than is to be obtained from a pig iron of similar analysis without this structure. He discovered further that with similar working and furnace burden the network structure was controlled by the blast temperature. When using a blast temperature of 900 degress Fahr. he is always able to get the network structure; whereas if the temperature is increased the network diminishes until at 1,100 degrees it disappears entirely with a corresponding lowering of physical properties of the wrought iron, the general chemical composition of the metal being the same. As the result of these discoveries the blast furnace manager has now fitted his furnace with pyrometers for recording the temperature of the blast and is able thereby to obtain more regularly consistent results.

Another criticism by a well known metallurgist was that although greater tensile strengths were associated with a network formation of the cementite and phosphide eutectic he thought the metal would give less resistance to shock or fatigue.

Rotary fatigue tests were taken by the Wheeler method by the Sheffield testing works on the bars whose structure is shown in Figs. 3 and 4 and these are given in Table III. Fig. 6 gives a general description of the methods of applying the test and the dimensions of the test bar. The comparative results are even wider apart than appears from the tensile results.

The fundamental law governing the phenomena of the formation of the network structure has not so far been definitely and satisfactorily proved. J. E. Fletcher, however, has furnished an explanation which has the greatest degree of probability. Mr. Fletcher is advising director to the British Cast Iron and Wrought Iron Associations and has devoted much thought and research to the elucidation of this problem in conection both with the blast furnace and the cupola.

He believes that this structure follows the original boundaries between the crystals of the metal which is first fused during the descent of the iron to the fusion zone in the blast furnace. The carburization of the crystals follows their boundaries just as decarburization follows them in the mechanism of the malleablizing process.

If the blast penetration effect while passing the tuyere zones is drastically oxidizing, following rapid carburization in hot blast furnaces, then the strong boundary-intercohesion is more or less

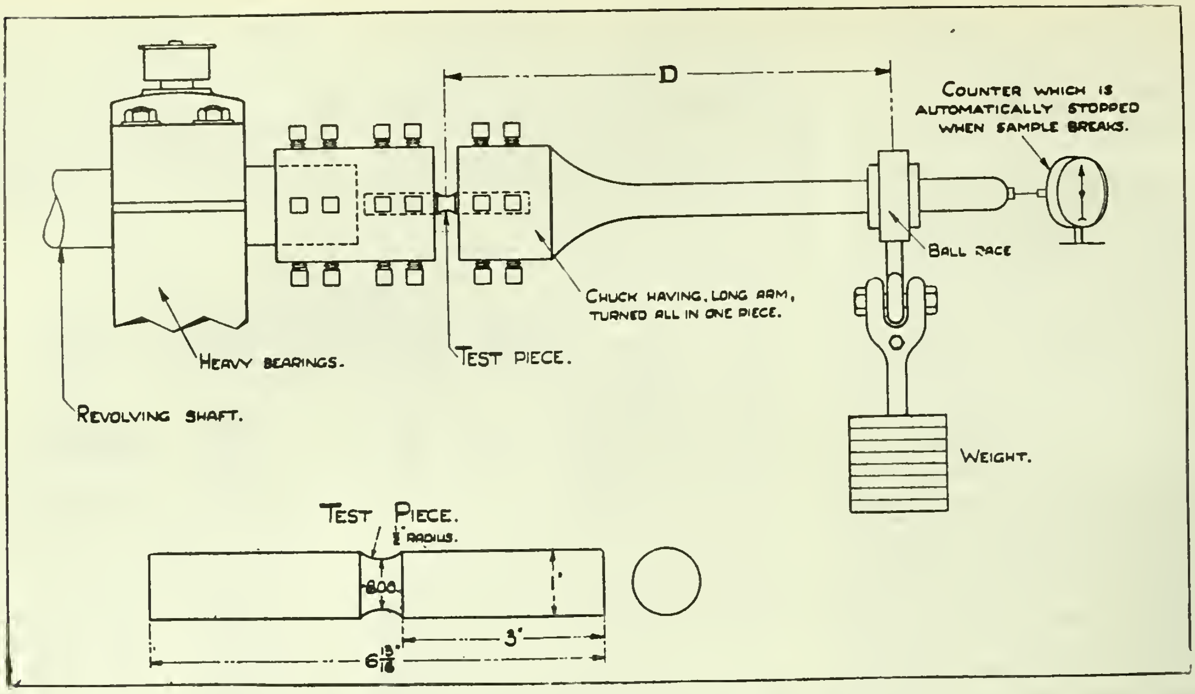


Fig. 6.—Apparatus for rotary fatigue test by the Wheeler method.

destroyed, with possible gas and oxide inclusions along the boundary films.

With the soft blast of cool or cold blast furnaces this action is absent, and the intercohesional strength of the crystalline structure, due to the presence of combined carbon and air—unimpaired by gaseous and iron oxides and minute slag inclusions—is maintained.

Points which the author has found helpful in producing regular results with this class of iron have been close attention to chemical analysis and regular testing for general hardness by the drill method. But it should be remembered that with these strong irons a much stiffer machine is required than that known as the Keep's machine. Owing to its lack of rigidity the author's experience with this machine has been disappointing.

Regularity of hardness, which is a governing factor of high physical properties, is only attainable by strict attention to blast pressure, and in this connection a recording blast pressure gage attached to the cupola is most desirable.

A test becoming general in Europe for cast irons of the highest physical properties, more particularly in connection with casting for Diesel and large gas engine piston and cylinder liners is the shock test. This is carried out by testing a bar cast 40 millimeters square supported on knife edges 160 millimeters apart by dropping onto it a weight of 12 kilograms from varying heights. Attached to the weight in such a way as to strike the bar in the centre parallel to the supporting knife edges is fixed another knife edge. The face of all the knife edges are rounded to a 1/16-inch radius. So far as the author is aware this test is not in use in America. A general arrangement of such a machine is shown in Fig. 7.

In carrying out a shock test we commence with a drop of the weight from a height of 30 centimeters increasing the height of the drop by increments of 5 centimeters until the sample breaks, the height at which the bar eventually breaks, being taken as the test figure. A result of 55 centimeters is considered none too high for the class of work

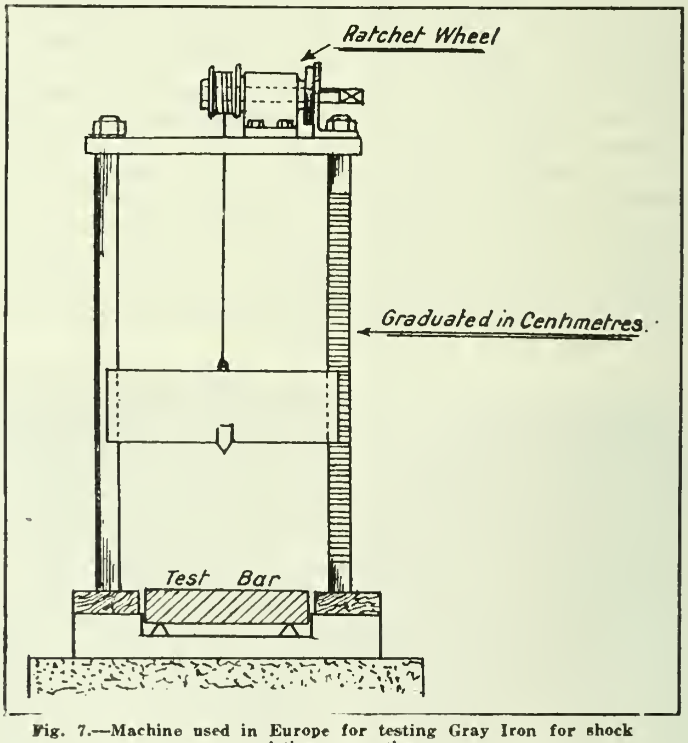


Fig. 7.—Machine used in Europe for testing Gray Iron for shock resisting properties.

named although it is quite a severe test. The maximum attained by the author has been 88 centimeters.

Mr. Wheeler uses the same sized bar and machine as a fatigue test, but for this commences with a drop of 28 centimeters and increases by heights of 1 centimeter. The number of blows required to fracture the sample should be taken as the fatigue test numeral.

A bar from the same metal as the tensile bar of Mr. Wheeler's referred to in the early part of the paper withstood 30 blows, having a range from 28 to 57 centimeters.

In conclusion if, as has been suggested in the first part of this paper, there is a wide difference in the strength of the respective gray cast irons, of which some particulars in regard to the

British have been given, the author would suggest the query whether this may not be due to the slow running furnaces in Great Britain producing metal having better properties than that made by the large, fast running furnaces which appear to be general in America. Unfortunately, even in this country, the slow running furnaces are diminishing in number.

The author's best thanks are due and are hereby tendered to Professor Turner for help with some of the micrographs and to Messrs. Bellis and Morcom for their permission to publish some of the results.

Appendix

To compare the breaking loads of two bars of similar material, but of circular and square section respectively, the bars being loaded at the center and supported at the ends, the length between the supports being the same in each case, let R represent moment of resistance of a section; Z, the modulus of section; fb, the modulus of rupture (transverse); Wb, breaking load; and L, length between bar supports.

The bending moment due to breaking load $= \frac{1}{4}$ WbL

$$R = Zfb$$

$$\therefore \tfrac{1}{4}\,WbL = Zfb \quad \therefore Wb = \frac{4Zfb}{L} \quad \ldots\ldots (1)$$

However the above formula is only correct within the elastic limit of the material. When test pieces are broken a constant arrived at by experiment has to be introduced:

Let fb=modulus of rupture as found by experiment.

Let ft=ultimate tensile stress as found by experiment.

Then from Lineham's "Mechanical Engineering," page 436

fb=Oft where O=a constant.

In the case of cast iron, O=2 tons for rectangular sections and 2.35 for circular sections. Substituting Lineham's value for fb in equation (1)

$$Wb = \frac{4Z.\,Oft}{L} \quad \ldots\ldots\ldots\ldots \quad (2)$$

Let Ws=breaking load on bar of square section

Wc=breaking load on bar of circular section

Zs=modulus of 1-inch square section (bending action)

Zc=modulus of 1¼ circular section (bending action)

Os=constant for square section=2. (for cast iron)

Oc=constant for circular section=2.35 (for cast iron)

ft is the same for both bars as they are of the same material.

From equation (2)

$$Ws = \frac{4Zs\,Os\,ft}{L}$$

$$\text{and } Wc = \frac{4Zc\,Oc\,ft}{L}$$

$$\therefore \frac{Ws}{Wc} = \frac{Zs\,Os}{Zc\,Oc} = \frac{2Zs}{2.35Zc} = .8509\frac{Zs}{Zc}$$

$$\therefore \frac{Ws}{Wc} = .8509\frac{Zs}{Zc} \quad . \ . \ . \ . \ (3)$$

$$= \frac{Ws}{Wc} = \frac{.8509 \times .1667}{.1917} = .7399, \text{ say } .74.$$

NOTES FROM THE CONVENTION

That Canadian are alive to the benefits of the Foundrymen's conventions and that they are keeping pace with everything progressive is demonstrated by the fact that W. G. Davidson of the Vancouver Engineering Works, Ltd, Vancouver B. C. travelled four thousand miles from that city to Rochester, which distance would have to be retraced in order to get home, in order to see the latest developments in equipment and incidently to purchase some. While in this eastern section of the continent Mr. Davidson visited several plants in order to compare them with Western foundries. The Vancouver Engineering Works is the largest iron and steel plant in the Province of British Columbia. Emil Drolet, who operates a large steel and iron foundry at Quebec city, travelled all the way to Rochester on a purchasing expedition. Mr. Drolet attends all the conventions and always does some business. On this occasion he purchased a molding machine from the Hannah Engineering Co. of Chicago.

Mr. P. McMichael, president of the Dominion Radiator Company, Toronto, journeyed over on purpose to select machines for his foundry. He left a good order with the Herman Pneumatic Machine Co., of Pittsburgh, Pa.

Alfred Congdon, representing the Port Arthur Shipbuilding Co. came all the way from the Algoma district of Ontario and made a good purchase from the Tabor Mfg., Co., of Philadelphia. It might be said in this connection that the Tabor Company sold everything which they had in their big exhibit and the representatives had nothing to attend to in preparing for and making the return trip with the exception of the tool hox which we understood they would take turn about in looking after.

CANADIAN TRADE IMPROVES

The Wall Street Journal of April 28, in a general review of the exchange situation as it affects Canadian funds says: "Rise in value of Canadian funds during the past 15 months is due to several reasons. Rise of sterling exchange, and consequent increase of English buying in Canada has had a notable influence. England and the United States are Canada's two best customers and the relations of the three countries have been fast approaching normal. Canadian trade has shown distinct improvement. For 1921 there was a small export balance, which was unexpected at the beginning of the year. Since January Canada has had an import balance, although a small one. It has been estimated that April trade figures will show an export balance as grain shipments have been exceptionally large. The factor which has had probably the greatest influence has been Canada's capital imports. In 1921, out of financing which totalled about $400,000,000, about $182,000,000 was floated in United States, and $16,500,000 in England. Loans floated in the United States in 1919 and 1920, were even greater than in 1921. So far this year Canadian financing here has been in good volume, although Canadian bonds held here which mature this year total about $62,000,000, most of them are expected to be refunded."

FAVORABLE EXCHANGE RATE

While the discount on the Canadian dollar in the New York money market is not expected to hold at one and a fraction per cent. for any length of time, it is freely predicted that owing to the favorable position shown by Canadian finance, it will remain below three and one half per cent. for a considerable time. Canadian funds last week were at a discount of one per cent. in New York, the lowest rate touched since January 10, 1918, before which Canadian funds had sold at a premium in the market for a considerable period. The rate had risen as high as 17½ per cent. in February, 1920. During the remainder of 1920 the rate fluctuated between eight per cent. and 15 per cent. with the average nearer the later, but early in 1921 improvement in Canadian affairs and finances began, which has culminated in the present value. Since turn of the year the rate has at no time gone beyond 6½ per cent., and since February 1 the highest has been 4½ per cent. During the past five or six weeks there has been a narrow market. The $100,000,000 Dominion loan floated in the States recently was the direct cause of the new high Canadian funds.

C. P. R. DEDICATES WAR MEMORIALS

Simultaneously in several leading Canadian cities, and also in London, England, imposing and impressive ceremonies marked the unveiling of memorial tablets dedicated to the memory of employees of the C.P.R. company who were killed in the great war. At Windsor Station in Montreal, His Excellency Lord Byng, E. W. Beatty, president of the company, and many other officials were present. In Toronto, the brass tablet was unveiled in the main waiting room of the North Yonge St. Station. At West Toronto the bronze tablet is located on the front facade of the depot building. Among other places where ceremonies were conducted were North Bay, Winnipeg and Vancouver.

Making Typewriter Frames in a Belgian Foundry

The process described is for a maximum output of from 35 to 40 frames a day. Had a greater number been required a different process might be more suitable.

By JOSEPH LEONARD.

TO SECURE a good practical result in the quantity production of typewriter-frame castings various conditions dependent upon the form of the whole piece must be taken into consideration. These conditions are governed by the size and relative position of the various bosses and sockets, by the necessity of producing a casting

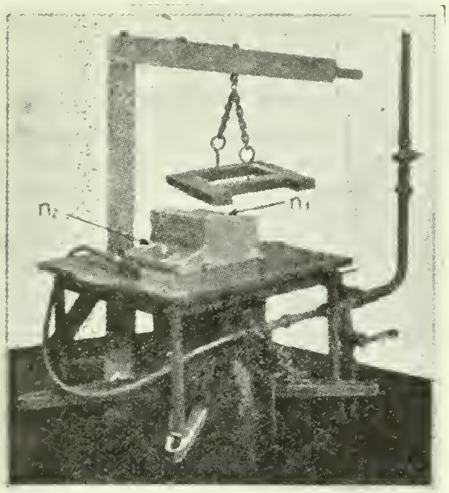


Fig. 1.—The molds are made on a jar ramming machine.

which may be machined readily, and by the further necessity of keeping the cost of production as low as possible.

The purpose of this paper is to present a few notes describing the method of molding and casting typewriter frames in a prominent Belgian foundry. Although the number of castings made is relatively large, the orders are probably not of a size which in the United States would be considered as placing the work on a quantity production basis. The maximum output provided for is 35 to 40 frames per day. This was considered insufficient for the installation of highly specialized equipment such as is found in American plants. Instead a comparatively simple rigging was designed to carry out the work.

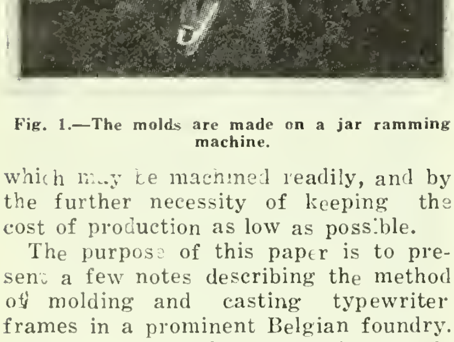


Fig. 2.—The drag flask.

The molds are made in a two-part aluminum flask, the drag being sufficiently deep to take the whole casting, the cope being nothing more than a flat cover. The casting is poured base upward, that is, the top of the typewriter frame on which the carriage runs is at the bottom of the mold.

The inside surfaces of the frame are formed by a large body core which has the same general shape as the casting and practically fills the mold. This core, which determines the metal section of only about 3-millimeters, or about 1/8-in. must be very accurately centered. To accomplish this two machined iron guide-pin sockets, d1 and d2, Fig. 2 are cast in the flask. Pins as shown in Fig. 3 are fitted into these sockets or bushings. These pins engage similar bushings set in the core which is thus accurately centered without relying on the judgment of the workman. The mold is dried. Two sands are used in making the core as will be explained subsequently.

Turning now to the details, the writer will endeavor to describe as fully as possible the methods adopted for molding, coring, assembling and casting, and as these different processes are described, some of the difficulties encountered will be discussed and the means employed to remedy them set forth.

Method of Molding

The pattern is in a single piece, and is of metal for the purpose of ensuring strength and precision. It is molded on plain jar-ramming machines of a type manufactured in England. The flasks used are of aluminum, and the details of the pin and socket arrangement mentioned above are as follows: There are two ears, p1 and p2, Fig. 2 on the flask, and two internal sockets d1 and d2, joined to the flask by ribs. This combination serves to strengthen the flask, and the sockets d1 and d2 are milled on the ends and rest accurately on the upper portion of the pattern n1 and on the boss n2, Fig. 1. It is clear that these two surfaces are always equally distant from the part of the flask forming the joint, which is planed smooth.

The bore of the two sockets in the flask is 22 millimeters in diameter, and they are well centered in relation to the ears p1 and p2.

In the core box there are two pins f1 and f2, Fig 7, their position corresponding precisely with the sockets d1 and d2 in the flask. While the core is being made two iron bushings b1 and b2, Fig. 5, are fitted over these pins.

On assembling the mold, two pins, e1 and e2, Fig. 3 are placed in the sockets in the flask; the core is next placed in position and the iron bushings b1 and b2 in the core are slipped over the pins in the drag mold, thus setting the core into the mold with great precision and obviating the shifting of the cores and injury to the sand which would be inevitable if the core were lowered into the mold without any guide. The core being in position, the pins e1 and e2 are withdrawn and the drag is covered with a cope in which the runners fixed on a

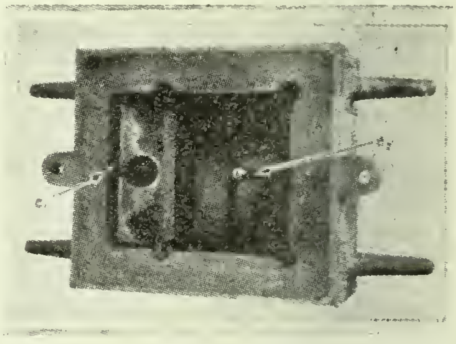


Fig. 3.—The drag mold showing pins for centering core.

plate of special design are directly reproduced by molding.

As already mentioned the molding machine is done with a metal pattern, with stripping plate on a jar machine.

In adjusting the molding a rather serious and very obvious defect was encountered. Our acquaintance with jar machines is quite recent. We had thought that jar ramming was sufficiently uniform to enable the machine to produce a mold practically perfect. This result, however, was not as had been anticipated, and the upper portion of the mold was not really rammed; on casting, the whole of the corresponding portion of the mold was swollen, the excrescences having to be removed in the cleaning shop.

We were led to make use of a cast iron plate which, during the jars, rammed the sand very firmly round h

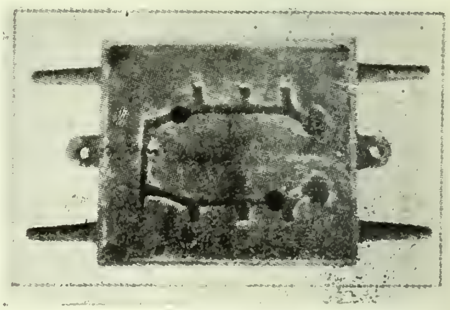


Fig. 4.—Cope mold showing gates.

piece, and this practically eliminated the defect in question. I do not know whether there is any other remedy, but if not I consider that this defect, which must recur and which has been repeated in our work with all pieces having sharp angles, indicates a weak point in jar molding. This may be easily corrected for pieces in series by using a plate, but which cannot be easily remedied for pieces not in series for which, it would seem, the jar machine is expected to be especially appreciated in Europe. This ramming defect has been observed not only by ourselves; among others, a large English foundry has experienced the same difficulty, and the jar machine operates as such for the first ramming. The sand in the upper part of the flask is rammed by hand. I mention this circumstance to our American friends who use jar machines regularly, and trust that I am not indiscreet in hoping to have their opinion on the subject.

Discussion between the advocates of the jar machine and the plate molding machine is frequent in Europe. I would

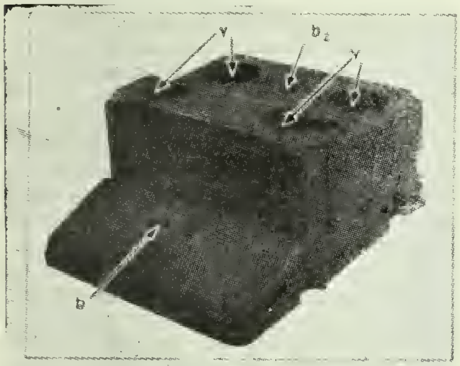


Fig. 5.—Main core showing bushings which fit pins shown in Fig. 3.

point out that, according to several trials made on flasks, without crossbars, the ramming of the frame dealt with in this paper is effected perfectly on a plate ramming machine. The fact that there are sockets and ribs in the flask is a difficulty in the use of these machines, but it may probably be obviated. I continue nevertheless to employ the jar ramming method, as the machine is installed and equipped with accessories and the results are good in practice; but if the manufacture of such castings had to be repeated I should consider the advisability of equipping a pressure machine for making the mold, and this with nine chances in ten of a successful result.

Molding Sand

The molding sand must obviously be prepared with very special care in order to obtain a very fine sand and consequently a sufficiently smooth molding surface. The apparatus for sand preparation is simple, comprising a crushing mill and a separator. The sand on coming from the separator is further passed through riddles with a 5-millimeter mesh to complete the action of

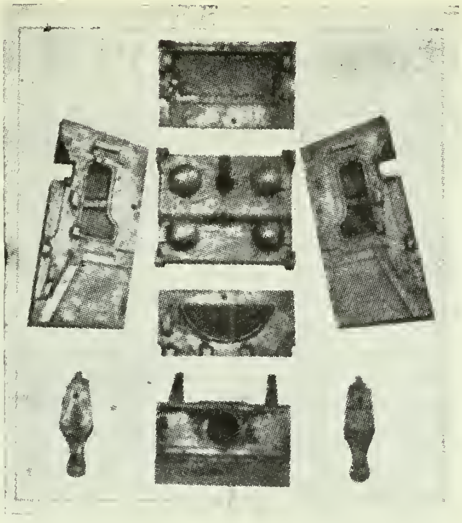


Fig. 6—A core as it appears on the drying plate, and in the opposite position from that which it occupies in the mold.

the separator. The preparation is done by the dry process.

Coring

The core box is of special construction. The shape of the core itself has necessitated the form shown in the accompanying illustrations. The various plates, made of aluminum on account of strength and lightness, being released laterally for the withdrawal of the core, and being assembled inside the wooden frame for making the core itself, the exterior of the core is composed of siliceous sand with a binding of linseed oil, dextrine and "avebene." This layer is about one centimeter in thickness, the interior being filled with ordinary molding sand for reasons of economy and in order to withstand contraction in the casting. If the entire core were of white sand, the casting being thin and the portion of burnt sand not at all thick, the core would offer the same resistance to contraction as fired white sand, which is very great. This method, moreover, is perfectly useless, as the cores obtained are sufficiently strong to enable them to be manipulated. These cores are not blackened. The core makers are required to ram the white sand sufficiently to obtain a very smooth

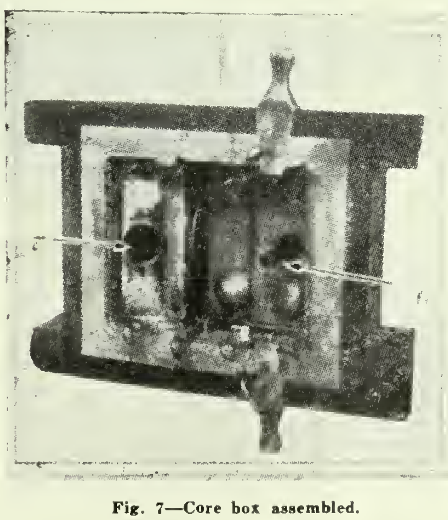


Fig. 7—Core box assembled.

core surface and a sufficiently fine internal finish.

Not only must the pouring of the piece be done very quickly but the metal must not have too long a distance to travel in entering the mold as it would cool too quickly, the mold would not be finished and the metal might harden. We use two basins for pouring and the molten metal enters the mold by a dozen tubes 7 millimeters in diameter placed around the mold.

The mold is top poured; the metal, on reaching the bottom of the mold, cools too quickly and whitens. This is inconvenient in working the casting by machine or file. We obviated this by pouring into the lower part of the core large masses of metal shown at Y Fig. 5 connected with the casting by an attachment 2 millimeters in thickness. On reaching this point the metal fills these cavities, producing in the lower part of the mold a certain circulation of metal which heats the mold at this point and enables the metal to cool more slowly.

The metal we have hitherto used has been composed as follows: Silicon 3.25, manganese 1.12, phosphorus 0.14, sul-

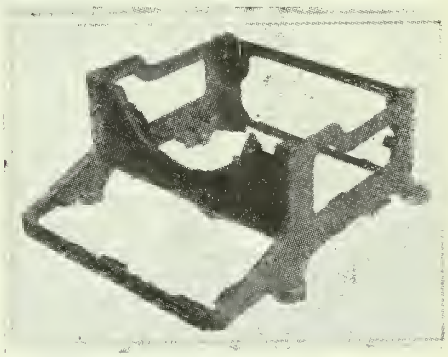


Fig. 8—Rough typewriter frame casting.

phur 0.09, total carbon 3.55, graphitic carbon 3.06 per cent.

In order, however, to facilitate still more the working of the casting we are about to make an experiment in reducing the manganese to a minimum, making it 0.4 to 0.5 per cent.

The charge of the cupola furnace must be tested most carefully and the proportions for the mixture must be adhered to absolutely, as these castings are among the most delicate which have to be made.

Canadian Electric Castings Co. of Orillia, are constructing a new building. They make electric furnace products, largely for mining and cement industries; also bronze, brass, iron and steel castings.

KILLAMETAL—WHAT IS IT?

We are in receipt of an inquiry relative to the purchase of this metal. It is said to be used for welding purposes and eliminates the use of solders. We have to admit that we never heard of this material and if any of our readers know anything about it they will be conferring a favor on us as well as on our subscriber who is after the information if they will write us.

Making Two-Part Castings in Three-Part Models

The extra parting allows the sprue and runners to be above the patterns, making more and better castings.

By WM. H. PARRY.

ON first thought advocating the use of three-part flasks in making castings usually molded in two-part flasks would appear an absurd proposition. However, there are conditions surrounding the rapid production of sound castings for pressure work which tax the ingenuity of the most expert foundrymen, and in the opinion of the writer, many of the difficulties can be removed by employing the three-part mold.

In these days of the almost universal use of production pattern-plates, it is not unusual to find that such plates do not always produce as many good castings as the number of patterns on them would indicate; in fact, in many instances not one good casting has been found among the great number cast.

It is not claimed that improper gating is the cause of these failures in all cases, but there is no question but what it is a contributing factor in a large percentage of lost castings.

In designing production pattern plates it is not always a good policy to crowd as many patterns into the confines of the flask spaces as possible, with the idea of increasing production, because frequently the result is exactly the reverse of what was intended. The number of plate patterns is restricted to the spaces not occupied by the runners and necessary connecting gates.

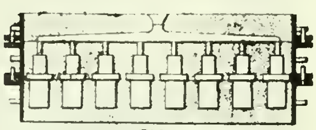


FIG. 1

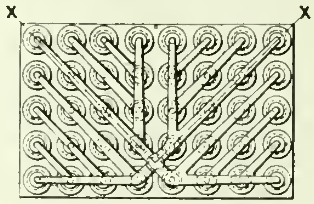


FIG. 2

Makes Mold in Three Parts

Fig. 1 illustrates a staggered section of a three-part mold assembled, showing the sprue and runner in the cope, the pop gates and the upper part of the castings in the cheek, and the lower part of the castings in the drag. Fig. 2 shows the position and number of patterns on the plate or plates and the arrangement of the runners and gates. Fig. 1 is a section of Fig. 2 on the lines x-x.

It will be noted that this is an apparently simple two-part job. At first, the work was planned for a two-part mold with gates attached to the flanges and two runners running lengthwise. The castings were to stand a hydrostatic pressure of 1,000 pounds per square inch after being finished all over, and hundreds of thousands of them were needed badly. However, every casting produced in this manner was porous and therefore it was evident that some other method of gating must be tried.

Pattern plates were made by the dozen each embodying some new method, but they all failed. Finally, a mechanic not connected with the foundry force, suggested the "three-high" idea. When he tried to explain how a two-part job could be better made in "three boxes" of sand, he was considered insane; nevertheless in desperation the foundry management tried his scheme. It succeeded beyond even the wildest hopes of the man who suggested it.

Three plates were made, the one for the cope being rigged with the runners and about one half of the sprue height, as shown at Figs. 1 and 2. The cheek plate accounted for the upper parts of the castings. Pop gates were attached to each of the 40 patterns, projecting upwards just high enough to come flush or a trifle under the flask height and engaging with the runners at points shown at Fig. 2. The drag plate was mounted with the larger of the two hubs. The sprue was so placed that the inrushing metal did not pour directly into one casting cavity, while the runners were designed to give the most direct passage to the metal.

Poured Forty Castings Per Mold

As tight flasks were used, it was possible to pour 40 sound castings to each mold. This was 17 in excess of the number of patterns spaced on the two-part flask plates as originally designed, and from which not one casting free from porosity was obtained.

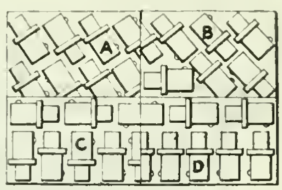


FIG 3

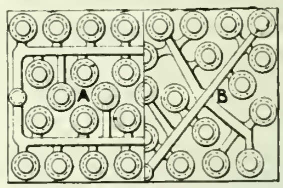


FIG. 4

One decided advantage in using the elevated runner method is that no attention need be paid to the runner or gate positions in placing and spacing the patterns other than to keep in mind that they must not be staggered so that the runner shape departs from easy flowing lines. However, a fair variation from a straight line is allowable. Again, this method lends itself to direct pouring in to the casting cavities and provides feeders to counteract gravity shrinkage in castings with heavy and deep sections on each side of a light flange.

On the original two-part flask plates the gates engaged with the flange so that the metal first flowed down then up in the cope. The upper hubs did not always fill, and when they did, sponginess was to be found at the junction of hub and flange.

In Fig. 3, A, B, C and D show four quarter layouts of a similar piece on split pattern plates, half on each side. The illustration indicates that many patterns can be placed on plates without any attention being paid to gates and runners, as they would be provided for in the cope of a three-high mold. If the layouts as at A, C and D, Fig. 3, are followed, 28 castings are possible, while if B is employed 26 can be obtained. This is at least eight in excess of what could be expected from the two-part flask method.

This well repays the extra labor of ramming up a shallow cope to form the overhead runner. Pop gates are not shown on these layouts, though they can be placed on either hubs or flanges, their position at times being determined by the ease with which they can be separated from the castings or located so that the following machining operations will remove all evidence of their presence.

In Fig. 4 the two half layouts A and B show the antiquated runners and gates usually employed to coax the metal into a two-part flask mold in an attempt to get sound castings. Layout A provides for a barely possible maximum of 33 castings with a chance of losing one-third of them, while layout B can be crowded to account for 29 with a fair chance for a 25 per cent. loss. The estimated loss percentages are in favor of layout B, because of the shorter run of the metal and the likelihood that some of the cavities in layout A will be filled with air only.

Fig. 5 is a layout of midway gatings

to the flanges, the metal being fed from the top runners located in the cheek and through uprights shown in section at Fig. 6. No great advantage in using this method is apparent other than that it may prove convenient on work that must be poured into the midsection of the casting.

Fig. 6 is a section of Fig. 5 at AA and illustrates the possibility of feeding 40 castings with only 16 upright feeders. This arrangement is of rather dubious advantage, but it can be adapted to some classes of work. Fig. 7 serves to illustrate how bad a runner layout can be to offset the virtues claimed here for overhead or bottom pouring.

It will be noted that 41 castings are expected from this plate. This number is obtained by crowding as many patterns as possible within a prescribed space, regardless of future consequences. Nevertheless, with all the crowding, there are seven waste spaces—A, B, C, D, E, F and G—which could be utilized as in Fig. 2, where the runners are laid out so that a mass of metal will not form at the sprue position as in Fig. 7. This condition, as illustrated in Fig. 7, is likely to create serious trouble when cooling.

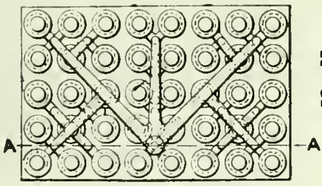


FIG. 5

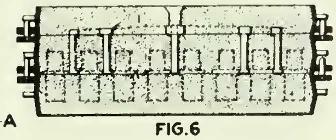


FIG. 6

Bottom Pouring Without Horn Gates

Fig. 8 shows how bottom pouring is made effective without horn gates. Bottom pouring is no more expensive than the ordinary method and is successfully employed on pressure work. Note how the sprue passes through the cope and cheek feeding the runners, gates and 40 castings just as easily as the old-fashioned horn gate fed one casting. As a matter of fact, it is easier by this bottom pouring scheme to make 40 or even a hundred castings than one with the horn gate. This would appear to be a wild statement, but on analysis it develops that the handling of a single horn gate to place in correct position, or near it, and keep it there, involves molding skill of a high order. Moreover much time is consumed in the operation. The delicate job of curving out the gate, while simple enough, requires an excessive amount of time.

On the other hand, with a three-part mold, a man with a machine, proper flask equipment, and good pattern plates can ram up two or three complete molds (40 castings to a mold) and can pour them off before the man using the horn gate method closes down his one mold containing a single casting.

In giving publicity to a scheme that involves the ramming of an extra flask, be it ever so shallow, to pour castings that are usually made or spoiled in two-part flasks the writer is not unmindful of the doubt that will be expressed by many readers. Nevertheless, in spite of the extra labor and the expense of increased flask equipment, this method will succeed in making sound castings at less cost than any other known method. It will be noted that no mention is made as to the use of risers as part of any of the three proposed methods, as that is left to the individual taste. A closer study of the bottom pouring system, as shown in Fig. 8, would indicate that risers taken off each casting would insure better work.

Another objection that may make some foundrymen hesitate before adopting this method is the extra labor entailed in separating the castings from the gates. A little study discloses the simple solution, which is to first cut through the runners, lay the castings on their sides, and cut through the gates. This method applies to nonferrous castings, in most cases when gray iron is used the castings can be knocked off.

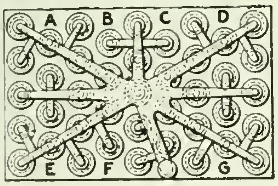


FIG. 7

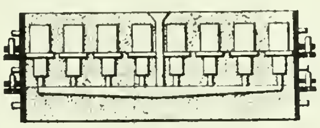


FIG. 8

It is but fair to state that snap molds cannot be expected to give results comparable with those of tight flask molds. The binding qualities of stiff metal flasks permit the placing of more patterns on a plate with a greater factor of pressure resisting safety, than would be possible with snap molds even when pouring jackets are used.

THE WORLD'S TIN RESOURCES: SMELTING CAPACITY IN EXCESS OF ORE PRODUCTION

The British Imperial Mineral Resources Bureau has issued new statistics relating to output of tin which show that the world's tin smelting capacity is considerable in excess of its tin ore production. The annual smelting capacity of all countries is stated as 175,700 tons, while world tin ore production in 1919 (the latest figures furnished) is given as 120,261 tons.

According to detailed figures received by the Bankers Trust Company, of New York, from its English Information Service, the estimates of annual smelting capacity of various countries are as follows:

	Tons
Great Britain	33,900
United States	30,000
Chile	12,000
Australia	4,700
China and Hong Kong	7,000
Straits Settlements	58,000
Dutch East Indies	16,000
South Africa	1,000
Canada	800
Germany	12,000
France	300

The above figures indicate that the British Empire's smelting capacity is 105,400 tons (including China and Hong Kong). Smelting capacity increased during the world war period due to the erection of new smelters in the United States, South Africa, Chile and Bolivia and enlarged capacity in the United Kingdom and Straits Settlements.

During the war period a general decline in tin ore production ensued. According to the Bureau's returns, world output of tin ore was 133,215 tons in 1913 compared to 120,261 tons in 1919. The Empire's production was 53 per cent. of the total in 1913 and 46 per cent. in 1919. Shortage of labor accounted in part for the Empire's decreased production.

The Bureau points out that the world decline would have been more general but for large increases shown by Bolivia after the year 1916. Bolivia produced 176,258 tons in the period from 1913 to 1919, and was second largest producer. The Malay States, a British protectorate, produced the largest tonnage, 321,323 tons.

The British Empire produced 445,967 tons of ore in the above period compared to 435,868 tons produced by the rest of the world.

The Bureau's report states that the world's consumption of tin is much greater than can be supplied from sources outside the British Empire and that the dependence of the rest of the world on the Empire for its tin is not likely to diminish.

After forging high speed steel it is always advisable to anneal the piece before hardening, as residual forging and cooling strain may cause breakage in the hardening process.

Oxy-acetylene Cutting and Welding in Foundry

Piped Oxygen and Acetylene Installations Are Recommended for Large Foundries. Many Uses Such as Cutting Steel Risers and Welding Grey Iron

By G. O. CARTER.

WHILE the oxyacetylene industry owes its development largely to the energy and efforts of sales engineers who have studiously sought out uses and users for the process, the industry is equally indebted to its far-sighted policy in carrying on research and application engineering to establish definite knowledge of the process—its limitations, as well as its possibilities. Indeed, one may say that, if the sales engineer was the chief agency in putting the oxyacetylene industry on its feet, research and application engineering are the forces that will hold the ground already gained and that will extend the process to realize its ultimate usefulness to man.

It is now several years since a few of the latter group of engineers began to make a close practical study of cutting and welding in foundries with a view to determining sound practices. Being unhampered by responsibility for the sale of apparatus or supplies, they devoted their attention to installations as a whole and to the establishment of correct methods of application of the welding and cutting processes.

Installation of Equipment

Oxyacetylene cutting is an important part of the manufacturing process in foundries, and it is always localized. For that reason the gases for the blowpipes can be supplied by means of pipe lines, and the foundry floor can be kept entirely clear of cylinders. This saves considerable handling of cylinders and is one of several operating economies that result from piping the gases.

When acetylene is piped to the cutting or welding station the generator should not be located immediately in the foundry but in a separate building, so situated with reference to the storage platform for oxygen that one can attend to both of the gases. There must be an adequate supply of fresh water for the generators and provision should be made for convenient disposal of the sludge. There are several reliable types of acetylene generators on the market, and in every locality are salesmen who will supply special information on request. The initial acetylene pipe line should take into account not only existing needs, but the possibility of future expansion. All-welded lines are giving very good satisfaction wherever they are in use. Their original tightness can be determined by the pressure and hammer test. Due to the character of construction, a line that has passed such a test satisfactorily should not require any outlay for upkeep or repair for many years.

Oxygen should be piped to the foundry from an oxygen storage and manifold room, so located that it will be easy to transfer cylinders from a railroad car or truck. Reserve oxygen cylinders should be stored on a platform level with the car or truck body, so that it will not be necessary to lift or lower the cylinders. If a level platform is used, the cylinders can be stored on end instead of being laid on their sides, as is the custom in many places.

Cylinders for immediate use should be rolled on end from the storage space to a small manifold room close by. As most foundries do considerable welding, as well as cutting, it is of advantage to use a low pressure pipe line to supply the oxygen to the welding station where the pressure need not exceed 30 pounds. This welding pipe can therefore be brought to the manifold and combined with the cutting system in a manner to utilize a considerable part of the oxygen remaining in cylinders after the pressure has fallen below the working pressures demanded for cutting. This may be accomplished by means of a three-section manifold.

In operation, one section of the three-section manifold is supplying oxygen to the feed line for the cutting station at a pressure of approximately 150 pounds. Another section of the manifold, composed of cylinders, which had previously served the cutting station until they could no longer maintain a pressure of 150 pounds, is supplying the welding line. These cylinders would feed the pipe lines to the welding station at a pressure of approximately 30 pounds. The third section permits the removal of empty cylinders which have been exhausted on high-pressure cutting and low-pressure welding lines and the substitution of filled cylinders which then stand by for high-pressure line service on the next shift. This section exists merely for the purpose of permitting the exchange of empty cylinders for full ones, so fresh cylinders will be immediately available and no time of cutting and welding operators will be lost.

In this combination high-class, large-capacity regulators are used between the outlets of the manifolds and pipe lines. These regulators, because each serves a separate line, do not require frequent adjustment. To avoid regulator difficulties that might result from cold weather, it has been found advisable to install a small steam coil near the regulators. In fact, it is desirable to keep the temperature of the manifold room well above the freezing point at all times.

It is customary to use 10 cylinder manifolds, as this insures a sufficient supply of gas for several hours, even in a busy foundry. This makes it possible for one man to attend to the oxygen manifolds and look after the acetylene generator, which ought to be of sufficient capacity to supply acetylene for an entire day from one charge to carbide.

The oxygen pipe lines shoulld be welded lines, carefully cleaned of oil, then tested to 500 to 600 pounds pressure to make sure of tightness. The valve should be controlled by well-made station regulators, so pressure regulation will be thoroughly dependable. These regulators ought to operate for long periods without giving trouble, because they do not have to be taken off cylinders and put on cylinders constantly, as is necessary with regulators when individual cylinders are in use. One of the advantages of having a steam coil near the oxygen regulator is the fact that warm oxygen is appreciably more efficient than cold oxygen, especially on heavy cutting, and for this reason, the coil is sometimes supplemented by a steel jacket placed around the pipe near the regulator.

The blowpipe, of course, is an important part of the installation, for it is in this apparatus that the two gases are combined for the cutting operation. There are many different makes of blowpipes. Correct designs, good materials, and proper workmanship are the most important factor. Different blowpipes have different characteristics. One type, for example, may be designed for high efficiency, another type for special freedom from backfiring, and yet another may aim at minimum weight. Each user will determine for himself what characteristics he requires in the tool and he will judge the blowpipe accordingly.

Whenever a blowpipe is used it should be kept in good condition so that gas passages are clear and the joints are leak proof. The proper tip should be used for the cutting work being done. Many operators have a tendency to use oversize tips, but this is not good practice owing to the unnecessary waste of the gases.

Holding Work For Cutting

For many kinds of cutting it seems advantageous to have the work lifted up, so that the risers will be on a level with the operator's hips. In such cases, cutting benches or frames should be provided to hold the castings. This might be called a part of the oxyacetylene installation because it is an important factor in the economical use of gases and in promoting clean cutting.

The welding station is an important part of the oxyacetylene installation, because there are many places where oxyacetylene welding can be used to advantage.

It is desirable to have preheating equipment and annealing bins at the welding station. If the castings in general are not composed of large units, the preheating should be performed in fixed furnaces, but either oil or gas burners should be provided for the preheating of large castings. Maintenance and repair welding and cutting can be used to great advantage in most foundries. For such purposes portable outfits, consisting of oxygen cylinder, oxygen regulator, acetylene cylinder and individual regulator should be used unless this work is to be done in close proximity to pipe lines. Such an outfit might well be called an "emergency outfit" and it would probably be placed under entirely different administrative control than that having charge of riser cutting equipment. The major uses of the process in a foundry are in connection with production. Maintenance and repair welding and cutting more naturally come under the maintenance engineer or master mechanic.

Operation of Cutting Process

We must recognize that in many foundries it is impossible to attain ideal conditions for one process without some other parts of the work having to make sacrifices. It is well to keep in mind, therefore, that to put out a large tonnage at the expense of efficiency, or where there is some other warrant, the cost will be higher than under more favorable conditions which permit of economic practice in oxyacetylene cutting.

Probably the most important things connected with cutting are the character and condition of the risers. It is highly desirable that they should be thoroughly clean. The soundness of a riser depends upon the molder and the steelmaker. Defects which show up at the neck of a riser are things which the foundry management is always fighting. The oxyacetylene cutter considers himself fortunate if he finds 75 per cent. of the risers thoroughly sound. The necks of the risers can be cleaned either by scraping or by sand-blasting. Where the risers are scraped the work should be done by a helper, as the operator's time is too valuable to expend on a purely preparatory operation.

Even a little sand interferes seriously with the cutting process, so the most satisfactory way of cleaning risers is to sandblast the necks, because this removes practically all of the sand.

Cutting Risers While Still Warm

Whenever it is practicable to cut the risers while they are still warm it is desirable to do so, because there is a saving of approximately 10 per cent in gas consumption. This is because the excess heat renders the slag more fluid, thereby improving the cutting efficiency. It is difficult to bring hot castings to the cutting frames, and the subject of hot cutting is at the present time perhaps of more theoretical than practical importance, but this is a subject that is receiving attention, and it is by no means assured that it will remain in the theoretical category. It is decidedly something to keep in mind, and wherever feasible the cutting of warm or hot risers will undoubtedly repay the foundry manager for a reasonable amount of trouble in handling the work.

One of the most interesting and useful developments in the study of oxyacetylene cutting practice in foundries is the segregation of castings having risers that are approximately of a size so that the operator can use the correct blowpipe tip and gas pressure. Where the castings are not segregated, if there is any considerable variation in sizes, the tendency is for the operator to select a tip that is capable of handling all the work, and the pressures naturally are set to enable him to cut the largest of the lot. It is easy to see how this might result in serious waste of gases.

Segregating Castings Into Sizes

There are many foundries in which some risers will be from 6 to 8 inches in thickness, while the bulk will be only 2 to 3 inches in thickness. There will also be considerable assortment of risers of intermediate thicknesses. If a blowpipe is set so that it will cut the 8 in. risers the full gas flow will be at the rate of not less than 700 feet of oxygen and 50 feet of acetylene per hour. For cutting the 2-inch risers the gas flow should not be greater than 200 feet of oxygen and 30 feet of acetylene per hour.

The segregation of castings into graduated sizes has been adopted by many progressive foundries and might well be adopted in many others. Little labor is required to land the castings in groups. Additional labor certainly would not exceed one man, whose compensation would be probably 40c. per hour.

Assuming that the castings have been properly segregated and that the cutter has disposed of the heavier risers with the most efficient pressures, he next adjusts his blowpipe for the cutting of the largest remaining series. This becomes a natural and justifiable thing to do where there is considerable cutting in each series, but it would not be either natural or economical if the castings were indiscriminately handled. If the cutter has an hour's work on the 2-inch risers, it is quite clear that in that hour he saves the difference between 700 cubic feet of oxygen and 200 cubic feet required for the different sizes. The actual saving is 500 cubic feet or two and one-half times the volume of oxygen required for the work on the 2-inch risers. The saving in acetylene is 20 cubic feet. These savings at the current prices of the gases amount to between six and seven dollars.

It would be difficult to segregate risers into a great number of groups, but it should be possible to use certain definite sizes of risers in the molding operation to facilitate separation at the cutting frame. Four groups, which do not require an excessive amount of handling for the average foundry might be sorted to take in risers of 2, 4, 6 and 8-inch risers.

With the segregation of risers into such groups, and the use of tips and pressures best suited for cutting each group, the savings alone should run from $15 to $20 a day for each operator. Such savings are well worth the consideration of foundry managers. Though there are many foundries that have adopted the segregation of castings as the orderly and economical way of handling cutting, I believe that only a few managers have a real conception of the amount of gas they are saving.

Foundrymen cutting risers 8 inches in thickness and larger can well afford to insist upon their operators' cutting with the proper tip and setting the regulator at the proper pressure for a given size, even though only one of a size is cut. A riser 10 x 12 inches costs more than $1.50 to cut. The total cutting time for such a riser would be about 10 minutes. The time necessary to get the correct adjustment would certainly not be more than one minute, and this at a 60c. an hour rate for a cutter, would cost one penny. By getting the best pressure for the work the saving would be at least 10 per cent. over the cutting costs when the operator depends on haphazard guessing, because he must always be sure of sufficient pressure, which, in such castings, means excessive and unnecessary pressures.

Speed Not Dependent Entirely on Pressure

Some cutters believe that excessive pressures enable them to cut faster. This is a fallacy, because in cutting a given thickness of metal the rate of cutting does not depend on the quantity of oxygen but entirely on the time interval required for the chemical reaction which takes place. When excessive pressure is used, a large amount of oxygen is blown through the cut without in the least helping to promote oxidation. The excess oxygen might have a slight beneficial effect due to the higher velocity of the gases which tends to blow the molten oxide from the kerf, but any such gain is not worth the oxygen wasted on it; besides, where correct pressures are used there should be no difficulty from choking of the slag in the kerf. Moreover, it has been noted in a good many instances that correct pressures are not only more economical in gas consumption than excessive pressures, but result in even better cutting speeds.

Still is should be borne in mind that a cutter will be almost sure to get into difficulty if his pressures are not high enough. Doubtless, it is his knowledge of this fact that actuates the operator who guesses at his pressures in almost a universal tendency to allow a generous margin of safety resulting in excessive pressure and consequent waste of gases. Blowpipe manufacturers provide cutting pressure tables for use with their equipment and the pressures prescribed in these tables for different thicknesses of metal should be closely observed and followed. As it is always possible that pressure gauges may get out of order, it is advisable to have the gauges checked against a good master gauge at frequent intervals, or in the absence of this service, operators should be checked by a test engineer who will direct them to cut under varying pressures until the best effective pressure for each thickness of metal is noted. If the best effective pressure does not check with that called for by the manufacturer of the blowpipe it is pretty conclusive evidence that the gauge is not functioning accurately and that it should be either replaced or adjusted.

Operators who are using correct pressures for cutting sometimes encounter difficulties due to blowholes in the riser. While it may be possible by the use of excessive oxygen pressure to continue the cut across blowholes of even an inch or more in diameter, such defects in risers always give considerable trouble and there is a much better way to handle the situation than by a wasteful use of oxygen.

When a cutter who is using the correct pressure encounters a blowhole he should at once change his position to permit of cutting from the other side of the riser, as this has been found much better than trying to "hog" his way through after hitting an obstruction. Experienced operators can "feel" blowholes and such operators switch to cutting on the opposite side of the riser with practically no loss either of time or of gas.

Cutting Through Blowholes in Risers

Some operators instead of stopping a cut when they "feel" a blowhole and starting from the opposite side, work around the riser, retarding the bottom of the cut as they advance the torch tip. This tends to leave a more open kerf and to keep the oxygen jet away from the blowhole until enough metal has been cut away to permit the cutting jet to work altogether on solid metal instead of encountering the blowhole, so the cutting operation can be completed normally. The same scheme of cutting around the riser is often used in cases where heavy cutting, such as 20 inches or more, is required, yet where the facilities do not permit an ample supply of oxygen for this heavy work. By cutting around the riser the actual depth of the cut at any time is not over two-thirds the thickness of the riser. This cutting around the riser is an interesting trick and takes care of difficult situations, but it is not the best practice, which is to have a big enough oxygen jet and a sufficient supply of oxygen, through a pipe line or manifold, to permit of straight-through cutting.

The cost of making the cut is not the only problem involved, because if a cut is not along the line desired additional cutting will be required to trim it to shape, or the excess metal must be removed by grinding. The major reason for using cutting benches or frames so the work will be at a level where the operator can control the direction of his jet exactly and remove the riser with one clean cut. Incidentally, the operator will naturally work faster and will probably pay more attention to the gas pressures, if he is working in a comfortable position.

Theoretically there seems to be no limit to the thickness which can be cut with the oxyacetylene flame. Within the past year or two, cuts have been made measuring 3 and 4 feet in depth. The quantity of oxygen required for such heavy cutting requires special provision for regulators, manifolding of cylinders, etc. This kind of heavy cutting also necessitates the use of special tips so that all the oxygen the torch can handle may flow through the jet. Unless a foundry is properly equipped for cutting exceptionally heavy risers and has operators who are experienced in the work, it would probably pay to call in a special operator whenever one of these difficult cutting jobs is encountered. Study of heavy cutting is being made, and apparatus capable of cutting almost any riser that can be poured will probably be available within the next year.

Effect of Cutting Metal

Anyone who has observed oxyacetylene cutting probably wonders what effect the cutting has on the metal. It is safe to say that dozens of investigations have been conducted on this question, as it is a particularly important one in certain lines of cutting. In the cutting process the metal is heated to a high temperature in the region of the reaction, but it cools relatively fast because the body of the casting is cool and conducts the heat away from the cut surface. On this account the extreme edge of the cut, where the intensity of heat has been greatest and where there is also a cooling action from the air, is of fine grain structure and somewhat hard. The effect of heat on the grain structure is observed under the microscope to extend from the cut surface to a point about three-sixteenths of an inch from the cut surface, beyond which all evidence of granular metamorphosis seems to cease. It is clear, therefore, that the hardening effect of cutting is localized, and if even an average machine tool cut is taken across the surface of the oxyacetylene cut, all of the affected metal is removed. Besides the effect on the grain structure, the cutting heat produces another effect on castings unless proper precautions are taken—it sets up strains of a more or less serious character. These tend to warp the castings, the degree of distortion depending largely on the shape of the section of the casting where the heat was applied.

On some castings the warpage is considerable and steps must be taken to overcome the difficulty. One way of doing this is to heat the entire casting to a dull red (at which temperature the cutting is done), after which the casting is permitted to cool slowly. Another way is to cut small sections at a time, permitting each section to cool down completely before undertaking the next cut. This method does not entirely relieve the strains in the casting, but largely prevents the warping. Where long cuts are made warping is primarily due to the fact that the body of metal is cold and that only one edge is heated. So long as it retains its heat the cut surface is capable of adjusting itself to the main body of metal, but when the metal along the edge of the cut is cooled down to the point where it develops appreciable strength, it no longer yields but pulls as the metal continues to contract in cooling. This effect is exactly the same that occurs in the cooling of a bar of metal, except in this case the bar is really an integral part of the whole. If the main section is relatively light and is long, the pull of the section which has been heated will cause warpage. If the main section is relatively heavy, there will be no warpage but there may be strains.

A thorough annealing of the casting should restore the proper grain structure of the metal and should entirely relieve all strains. If the casting is warped, however, relieving the strains by annealing will not bring the casting back to its original shape.

To conclude the discussion of the cutting process, the writer desires to mention a relatively recent development, namely cast iron cutting. Apparently, this form of the cutting process is not advantageous for foundry use at present, as the cutting action is slow as compared to the reaction in cutting of steel, and much larger quantities of oxygen are required. Cast iron cuts can be made, however, which closely resemble steel cuts, being real cuts and not merely sections melted out.

Welding Applications

Oxyacetylene welding is not used in the average steel foundry to the extent that the cutting process is employed, but it merits most careful consideration in foundries of all kinds. When properly made, the oxyacetylene weld should be as strong as the original base metal of a steel casting. It is highly important, however, that the proper filler rod should be used in the welding of steel castings. It never is advisable to use Norway welding wire, for example, as the deposited metal would be wrought iron and, therefore, of different composition and strength than the metal in the casting. If, however, the welding rod is properly selected to give a deposited metal similar in composition to that of the casting, the oxyacetylene weld metal can be counted on to thoroughly bond with the original metal and to be of almost the same composition. Being in a cast condition, the deposited metal should be equal in strength to the original casting.

In welding we must watch the effect of heat on the casting to avoid warping and the setting up of strains. Neglect of this precaution accounts for many unnecessary failures of castings which have been otherwise correctly oxyacetylene welded. Where welding is done on a large section, a considerable area will naturally be at a high temperature, and on cooling down will undergo severe contraction. If this effect of the heat is permitted to cause failure of the metal, it is the fault of mechanics and is not a failure of welding. There is one certain way of preventing this bad effect of heat, and that is to have the entire casting heated so that the cooling down will be uniform in all parts. Incidentally, if the quantity of welding amounts to even 3 per cent. or 4 per cent. of the total volume of the casting, the heating of the casting in a furnace or by an oil or gas and air heater will probably save enough oxygen and acetylene to more than offset preheating cost. Preheating is advised whenever castings are oxyacetylene welded, and if it is not practicable to completely preheat a casting it should at least be locally preheated so as to make sure no serious strains will be left in the casting when it has cooled down.

It is of utmost importance that the cooling down of welded castings should be a slow process, and to insure slow cooling a welded casting shuld be [illegible] ered with sand or should be placed in annealing ovens or bins. By doing this the casting will cool down from the annealing temperature so slowly that the cooling will be uniform.

In gray iron castings oxyacetylene welding is used almost altogether. In this work the welding rod should be made of gray iron of excellent quality that is high in silicon content, and a flux should be used to work the oxide out of the molten bath.

Preheating is even more important in the welding of gray iron castings than in the welding of steel castings, and the subsequent annealing is equally as necessary. The actual making of a weld in gray iron is an easy operation, though In gray iron the resulting weld should be of even better quality than the casting, because the deposited metal can be cleaned thoroughly.

In most gray iron foundries the welding is placed on a production basis, the castings being heated in annealing ovens and then carried to the welding stations where they are properly welded. They are then returned to either the annealing bins or to sand pits where they are covered and allowed to cool down slowly. In some gray iron foundries the number of acceptable castings per hundred poured has risen very decidedly through the use of this real production welding.

Welding in steel foundries can well be given fresh consideration, because through use of a three-section manifold sufficient oxygen to do the welding will be obtained from the cylinders after they have been utilized for the cutting work. This oxygen may be considered as of no cost, because it is pure salvage. It does not pay to take [illegible] cylinders from one manifold to another, or to carry them from a cutting station to a welding station, but it does pay to save this gas if a three-section manifold is installed. In view of the excellent quality of the deposited metal [illegible] tained by the oxyacetylene process, the whole problem of welding should be thoroughly studied by foundry managers. In some cases, where welds are made by other processes, it will pay to add a layer of oxyacetylene welding owing to superior machining quality of the deposited metal.

Maintenance and Repair Work

Attention should be called to the numerous uses for the oxyacetylene process in maintenance and repair work. As this kind of work is separate and distinct from production work, it will pay to have a skilled repair welder and cutter rather than to depend upon one of the regular foundry operators. It is well for such a man to be a good mechanic in addition to being an oxyacetylene welder and cutter.

Oxygen alone is used for burning out furnace tapholes when they become badly plugged with frozen metal. Oxygen alone is also used for drilling into skulls and salamanders. These uses for oxygen are assuming great importance in the steel mills and oxygen burning is also becoming more and more a recognized operation in modern foundry practice.

The oxygen cutting torch is used in cutting out structural steel, sheet steel or cast iron parts to be removed in demolition work. When making changes in plant structures (such, for instance, as the installation of new cranes) old columns, frames, etc., are frequently removed, and these changes can be made on a very few minutes' notice with the cutting torch used either for burning out rivets or for cutting through sections. When new parts are ready for installation, changes can frequently be made during the noon-hour, or on holidays, thus saving much productive time.

Cutting is used in removing parts of furnaces, cupolas, gas producers and numerous other kinds of equipment employed in foundries. Constructively it is used in shaping structural and sheet steel which is to be used in new equipment.

Oxyacetylene welding is being used more and more around all industrial plants for welding of broken parts, welding patches into sheets when corrosion has necessitated cutting out bad spots, etc.

In new construction welding is most useful for installing pipe lines, making steel tanks, bins, oil receptacles, gear guards, etc. The master mechanic who understands the possibilities of oxyacetylene welding can keep a welder busy all of the time around a foundry. In some places the oxyacetylene welding torch is being referred to as a "one man machine shop," which clearly indicates its adaptability to almost any welding or cutting problem that is likely to arise.

Recapitulation

1. In the larger foundries a new type three-section oxyacetylene manifold will pay rich dividends on the investment and provide oxygen for welding at almost no cost.

2. Piped oxygen and acetylene installations are desirable in large foundries because they obviate handling cylinders for regular production cutting and welding in the foundry proper.

3. To obtain the best results oxyacetylene equipment must be regularly inspected and properly maintained.

4. The managerial phase of gas cutting and welding is as important as the technical phase in securing maximum efficiency and economy.

5. Repair welding in the foundry is well worth while and should be under the supervision of the master mechanic rather than under a production official.

6. Oxyacetylene cutting of cast iron is often a useful operation but it is not economical for regular cutting of risers in gray iron foundries.

7. New uses of oxygen and acetylene are being discovered almost daily and foundries can well afford to follow the lead of steel mills in adopting many of the new uses and practices.

8. Segregation of castings according to the sizes of the riser necks may be counted on to more than repay the expense incident to such segregation.

9. Proper elevation of work and comfort of operators are worthy of close attention.

10. Recent developments in the oxyacetylene welding and cutting industry are such that no one can safely accept conclusions as to its limitations, unless these conclusions are based on a knowledge of present conditions. For this reason most foundrymen and others can well afford to make an entirely new survey of cutting and welding with regard to the possibility of introducing or extending special applications of the process in their establishments.

BLASTING BY LIQUID AIR

Liquid air which was produced in Great Britain—as a result of the wonderful experiments of Sir James Dewar—has now became a commercial product. Some experiments of a most successful kind were carried out recently by a British company in the use of liquid air as an explosive. A paper cartridge filled with a material rich in carbon was used, after having been soaked for a quarter of an hour in liquid air containing eight parts in ten of oxygen. Cartridges of this type were charged into the holes to be blasted and were fired by means of an electric spark. The combination of the oxygen with the carbonaceous material created a sudden and enormous volume of gas with a strongly explosive effect.

Melting Tests, Changing Mixtures During Run

Showing That Iron in the Upper Charges Will Be in the Castings Made From the First Charge, No Matter How Carefully Separated

By RICHARD MOLDENKE

AS THE foundryman oftentimes is confronted with the necessity of running special charges in the first part of his heat to turn out castings of a different character than his regular line of production, he will be interested in knowing what are his chances of keeping the several mixtures separate. The comparatively higher labor costs in America preclude the running of a series of small cupolas, each with its own mixture, as is done in Continental Europe, and hence the single, large cupola must serve with what protection a double coke charge between the mixtures will give.

It is quite common to find two mixtures run in the day's heat, and occasionally one finds three of them, depending upon the lines of work to be cared for. The smaller tonnage is always put through first, to get it out of the way, and if there are two mixtures for small amounts to be handled, the harder one is charged first. As such extra mixtures usually contain steel scrap—some of them high percentages—it is advisable to make the first charge one without steel or fine scrap. In the first case the melting steel falling upon the cold bottom will surely stick, and in washing away as the heat progresses affect the succeeding charges unfavorably, apart from giving the first ladle of iron without much benefit from the steel used. In the second case, with fine scrap in the mixture this will melt quickly and drip down on the bottom before the heavier sectioned iron melts, and thus give an erroneous impression of the height of the bed by yielding a flow of molten iron several minutes too soon.

With the first charge out of the way and the bottom well heated by this iron, and the second charge with its steel first, pig next and lighter scrap on top in uniformly spread layers, an even melting should take place as far as this may be carried out in the cupola process. Placing at least a charge and a half, if not a double charge of coke between mixtures, and pouring the transition metal into work that will be satisfactory with both mixtures, a reasonable degree of success can be attained.

However foundrymen will have noticed that the separation of the several mixtures is not nearly as effective as can be wished. For instance, where several charcoal iron charges, having a low phosphorus content, are put into the cupola first, and after putting on a double coke charge, the subsequent higher phosphorus iron charges go on up to the charging door, it has been noticed that the phosphorus content of almost the first iron is higher than it should have been. This shows that some of the upper charges must have melted along the lining of the cupola, and contaminated the purer iron of the lower charges. Instances of hard iron where soft was expected, and vice versa are common knowledge in the foundry. The analyses in a series of tests recently made with Mayari pig iron which contains nickel-chromium, showed this intermingling of charges so plainly that it was deemed important enough to present to the foundry industry in form of a short report.

An extended research was made for the Bethlehem Steel Co. on the characteristics of their Mayari pig iron, made from Cuban ores carrying nickel and cromium. The composition of this pig iron runs about as follows:

	Per Cent.
Silicon	0.50 up to 3.00
Manganese	0.90
Sulphur	0.03
Phosphorus	0.065
Nickel	1.20
Chromium	2.40
Titanium	0.18
Vanadium	0.05
Total Carbon	4.00

From this composition it will be seen that the nickel-chromium content is a prominent characteristic, and being so different in this respect from any other pig iron of the country, it is easily traced in its behaviour in the cupola by the analysis of the metal made. With titanium reduced from the ore, and an almost negligible sulphur and phosphorus content, for cast iron, this pig iron stands out as rather exceptional. It is gratifying to know that about 500,000,000 tons of this ore is in sight on 25,000 acres, in Cuba.

In the research above mentioned, almost every combination of the elements in iron, as used in the foundry, was to be tried out. The great slump in business necessitated a general cut, but nevertheless 245 separate tests were made with 1,155 bars. These were made in the crucible, after 36 tests, with 135 bars therefrom, had been made in four foundries melting four or five separate mixtures ahead of the day's run in each case. The highly interesting results of the crucible tests will be published as a separate monograph, while the results of the cupola tests will be gone into here, to show how unreliable the cupola melting process is for exact melting results, despite its advantages for cheapness and simplicity in operation.

In making up the charges for the cupola, the first one was arranged to contain no Mayari pig iron at all. The second charge, separated from the first one by twice the amount of coke needed, or using a ratio of 5 to 1, instead of 10 to 1, contained 10 per cent. Mayari pig iron. The third charge had 15 per cent. Mayori, and was similarly separated from the second charge. The fourth charge had 20 per cent. Mayari iron, in similar manner. Where a fifth charge was run, this consisted of whatever mixture was found convenient, usually with steel to reduce the total carbon. It will be seen, therefore, that the charges were much more widely separated than would have been the case in charging the same mixture, repeatedly, and therefore, melting could be expected to be fairly separate. It was only after the trial was made in foundry after foundry, that resort was had to the crucible department of the Bethlehem Steel Co., which generously detailed an entire unit of its large regenerative furnaces, holding 24 crucibles at a time, for this purpose.

In order to have the results as comparable as possible, even the scrap used was first made by remelting a standard pig iron in 5 ton batches. A mixture of 60 per cent. pig and 40 per cent. scrap was used in every case, the Mayari pig iron forming part of the pig, when it was used. The laying out of the mixtures need not be gone into here; it is sufficient to say that every effort was made to have the program as exact as this could be made consistent with ordinary foundry routine. The charges varied from 600 to 2,000 pounds each, depending upon the cupola of the particular foundry. The surplus metal went directly into castings. Two sets of cores arranged for three test bars each were poured off for each mixture, the cores being parked together and rammed up in a flask. The A. S. T. M. arbitration bar, 1¼ inches diameter, and 15 inches long, poured vertically, was used, being afterward tested for transverse strength and deflection on supports 12 inches apart, for tensile strength, and for hardness by the Brinell test. Micrographs also were taken. A complete analysis was made for each set of bars of a mixture.

The following figures summarize the results:

Charge No.	In Mixture Ni.	Cr.	Ni. Range
1	0.00	0.00	0.08 to 0.12
2	0.12	0.24	0.09 to 0.13
3	0.18	0.36	0.08 to 0.11
4	0.24	0.48	0.08 to 0.12

Charge No.	In Castings Ni. Aver.	Cr. Range	Cr. Aver.
1	0.10	0.16 to 0.24	0.23
2	0.11	0.23 to 0.37	0.28
3	0.10	0.23 to 0.30	0.27
4	0.10	0.23 to 0.38	0.28

(Continued on page 46.)

Latest Developments in Molding Machinery

Surprising Advances Made During the Last Two Years—Shockless Jolters, Automatic Time Jolters, Double Squeezers, Mold Fillers, Sand Throwers, Seen at Rochester Convention

By F. H. BELL

THE molding machine, as has been pointed out in these pages is, like all machines and devices, dependent on the six mechanical powers: viz., the lever, the wheel and axle, the pulley, the inclined plane, the wedge, and the screw. When we consider the wheel and the pulley work on the principle of the lever, and that the inclined plane, the wedge, and the screw are in many respects similar to each other, it will be seen that the designer does not have much choice of movements when designing a machine, but when we behold how many different duties these simple powers can be made to perform it puts the machine in a different light. Machines have been used to lessen the labors of man for ages in almost every line of activity excepting that of foundry work, but this field seemed to look uninviting. The belief that no machine could endure the wear and tear of the sand was the main obstacle while the limitation of its usefulness was also put forward in opposition to any attempt to do much investigating into the possibilities of molding by any other means than that of the method adopted by Tubal Cain and carried on by the Egyptians and by Hiram the great artificer in iron and brass. It is hard to believe that Hiram's methods are still in vogue in most of the foundries of to-day but such is the case. They are, however, rapidly giving way to modern methods which have made such radical changes in other lines. An annual visit to an exhibit such as accompanies the foundrymen's convention shows what is accomplished in a year, but when we skip a year, as we did after the convention of 1920 during which time the foundrymen were at their wit's end to know how to meet competition we have a chance to see what can be accomplished in two years to solve the difficulty. Jolt ramming, as every molder knows, saves him the trouble of ramming by hand. It does better work and more of it. The jolt ramming machine of two years ago was so arranged that when the molder got a good ready on he pulled a lever which admitted the compressed air which did the jolting. When he thought he had jolted it enough he turned off the air. The jolter of to-day has a simple automatic arrangement which is "set" for so many molds per hour. By this means the machine jolts automatically every so many minutes and seconds according to what it was "set" for. With this arrangement all the molder has to do is to keep up to the machine. While the covers a lot of the ground in the molding machine field it is not everything as the squeezer which was probably the earliest type of molding machine is still the most useful type on some lines of work. When using a match plate it is quite possible to squeeze both cope and nowel in one operation, but when using the squeezer in conjunction with the stripping plate it has always been necessary to have two machines and either have two operations or let the one man run from one machine to the other. This same difficulty was to be found in the plain stripping plate machines unless where both top and bottom were the same. The machine of to-day has both stripping plates on the one machine and is squeezed in one operation in a power squeezer.

There are machines which combine the stripping plate or some other pattern drawing device with the jolter and the squeezer. These have been in vogue for some time and have given good general satisfaction but the jolting feature had the tendency to shake other molds in the vicinity of the one being jolted. This was overcome in different ways—by pads, springs, air cushions, etc. The latest invention is to have the lower part up and meet the downward thrust of the table and have the blow to be struck away from anything solid. This is a real shockless jarring machine. The number of attachments which may go along with a molding machine and which may be rightly classed as part of the machine would be hard to enumerate but one which could easily be included in any machine of any considerable size is the sand delivering attachment. Shoveling sand into a flask by hand does not look like a very advanced idea, and like man yother antiquated ideas is giving way to machinery.

MAKING CORES ON A MACHINE

Making cores on a machine is an invention of comparatively recent origin. In many respects a core can be made in a similar manner to a mold, but a unique system is to have the sand forced into the core box by means of compressed air.

The Demmler Air Operated Core Machine, recently placed on the market by Wm. Demmler & Bros. of Kewanee, Ill. proved an interesting feature of the Foundrymen's Exhibition. This machine blows the sand into core boxes of irregular shape, making a firm vented core.

It automatically clamps the core box firmly, then fills it and releases immediately after the box is filled. The several operations are performed almost instantaneously, making a core in less than five seconds.

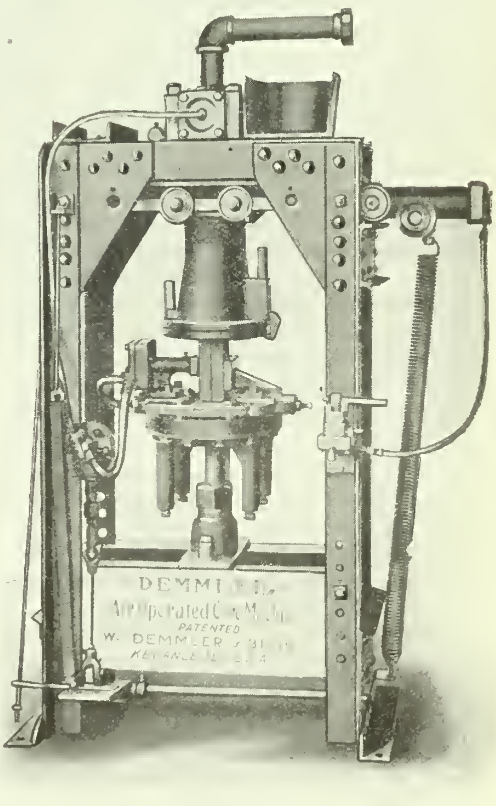
It is controlled by a lever which the operator presses with his foot, simply pressing the lever and releasing.

To operate the machine, the magazine, which travels back and forth having a cross-head mounted upon rollers and pushed by a push cylinder controlled by a small hand valve, is moved back to register with the sand supply and filled, then moved forward to register with the air chuck, taking the position shown in cut.

The core box is placed in the chuck and the treadle is pressed down and released, the core box which has been filled is removed and its successor is inserted in chuck. This operation is continued until the sand in the magazine has been used, then the magazine is refilled for another run of cores.

A quartet of these machines were shown operating, making cores for faucets, valves and cocks, proving an instructive exhibition which was enjoyed by the foundrymen.

The valve cores were made of a stiff sand mixture to stand up while baking, the faucet cores were made in multiple core box of sharp sand and oil binder.



Demmler air operated core-making machine without the automatic sand elevator.

F. H. BELL, Editor

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The Rochester Convention

THE FOUNDRYMEN'S Convention at Rochester was, as predicted it would be, a decided success. The citizens of Rochester along with their local committee were enthusiastic about making it a success and about having their guests go away with a favorable impression of Rochester.

Rochester is a city which leaves a favorable impression on its visitors, apart from its citizens. Many comments could be heard regarding the mercantile section. Main Street is wide and apparently the best lighted street in America, as it is quite possible to read a newspaper with ease on any part of the street at any hour of the night.

The exhibition buildings and grounds as well as means of transport were all that could be desired.

The convention surpassed any previous ones in many respects. The fact that English, French and Belgium foundrymen could hand American and Canadian foundrymen some eye-openers added interest to the sessions and brought out discussions which would otherwise have been less spirited. The registered attendance and the number of exhibits has been slightly surpassed on a couple of former occasions, but this was to be expected, following a depression such as we have been experiencing for the past two years.

The banquet at Powers Hotel was well attended and appreciated. The speakers of the evening—three in number, held the attention of the audience while they talked on their respective subjects.

The excursion on Thursday afternoon and evening was well patronized and everyone enjoyed the splendid program prepared for the occasion. The sight-seeing trip for the ladies was the most easily accomplished feature for the committee in charge, as sights were in welcome in every hand.

All told the trip to Rochester will be a pleasant memory and the convention of 1922 will go down in history as a real live one, up to expectations in every respect.

Should Canada Have the Convention?

NOW THAT the convention of the American Foundrymen's Association is over, the question arises, "Where will the next one be?" Assuming that the United States has about fourteen times our population and that their foundry business is about fourteen times as great as ours, we should have the convention every fourteen years.. In June 1908 the convention was held at the Canadian National Exhibition grounds, Toronto. Add fourteen years to this and we are about due again. Our Exhibition buildings are unsurpassed anywhere on the continent and we have hotel accommodation equal to any city on the continent with our population. But there are other places in Canada besides Toronto and Canadian Foundrymen are not Toronto Foundrymen any more than Halifax or Vancouver Foundrymen. We are prepared to assist in endeavoring to secure the convention and exhibition for any place in Canada if foundrymen will express themselves as being favorable to having it.

To hold a convention such as the Foundrymen's, requires hotel accommodation for several thousand over and above the regular business of the city, which is not handy to get but we have it in different Canadian cities. Freight rates are no greater coming into Canada than to United States points, and our location is more favorable than most American points.

From Chicago to Toronto is a much shorter trip than to Boston, Philadelphia, New York or Atlantic City. Yet successful conventions have been held in all of these places.

From Chicago to Montreal is exactly the same distance as from Chicago to Boston. Take southern cities like Cincinnatti and Philadelphia, it is twice as far from one of those cities to the other as it is from either one of them to Toronto.

Another point to be remembered is that there are less than a dozen cities in the United States with the population of Toronto or Montreal. As a matter of fact there are less than half a dozen. There are lots of things, favorable to Canada which few Americans and few Canadians are aware of and these we propose to bring to their attention, providing that Canadians are enthusiastic about having the American Foundrymen's Convention in Canada next year. Those who attended the convention at Toronto in 1908 remember the good time which they had; the splendid accommodation and the good business done, but they have one grievance which they cling to—the contemptible treatment which they received at the hands of our customs department. This, we are assured, is no longer permitted and that if all other things are satisfactory the customs officials will be no hindrance, so it is up to Canadians to say if they want it, and Canadian Foundryman will stand ready to do its share. We can get the convention if we go after it, but they are not going to chase us around and coax us. Let's hear what the general opinion is?

Canada and the United States

LAST month we pointed out a few of the most prominent characteristics of these two countries. These were favorably commented on by our neighbors to the south, but while they were considering these they were having their attention drawn to some new ones.

Rochester, where the convention was held, is on the south shore of Lake Ontario, and the peculiar shape of the map of this part of the world makes American shipping a doubtful proposition, with the result that the stars and stripes are seen on very few boats on Lake Ontario or the St. Lawrence River, while the Canada Steamship Lines, cover these waters and the ports along both sides.

When the visitors to Rochester were being entertained to a trip on the lake on one of the finest boats on fresh water they were surprised to find that it was a Canadian boat, and while on the lake they were still further surprised to see one of the regular line of Canadian boats which runs all the year around between Cobourg and Charlotte crossing with a cargo of loaded freight cars on the lower deck and passengers on the upper deck.

Their amazement was still further augmented when on the return trip they beheld the steamer "Toronto" another Canadian ship just leaving the harbor with the members of the Rochester Chamber of Commerce on a three day cruise down the St. Lawrence to Montreal and other Canadian ports. They did not know that Canada had any steamship lines, or that it was possible for Canada to build these steamers as well as their power equipment, but the couple of thousand who took in the excursion know now that there is something to Canada.

Both countries are to blame—Canada does not put herself to the front and Uncle Sam intentionally teaches his school children that there is only one country in the world that is worth learning anything about. This may be all right to a certain extent, but it has its limits. United States may be the greatest nation in the world, but it would be still greater if it would expand its vision so as to see what is going on elsewhere, particularly in the territory of its next door neighbor.

When Professor Tesla perfects radio so that seeing around curves and at long distance will be as easily accomplished as talking over long distance without the aid of a wire we will become better acquainted. This, he claims he will be able to do before many years, but in the meantime we will have to bring the Foundrymen's Convention over here and let our neighbors see how we are progressing.

It would be to the advantage of both countries to know each other better, and no better way presents itself than by having interchange of conventions.

Our Aims and Aspirations

THE FOUNDRYMEN'S Convention which has just closed and which was considered too big a risk to undertake last year demonstrates that times are getting better. Conditions are far from booming but they are greatly improved, and each month finds them better. Manufacturers are beginning to speak in terms of satisfaction about present conditions, which is much better than looking optimistically to the future which was the best that could be said of a few months back. Everything now looks encouraging, and all that is required is to proceed as though nothing was wrong and things will gradually shape themselves into normalcy.

Canadian Foundryman is not given over to optimism and when we know that business is bad we do not try to argue to the contrary, but prefer to present conditions as we find them. However, things look all right now and we will pass them on as such.

The present issue of this publication while giving a report of the convention is a fair sample of what we aim to present to our readers each month. When we do not report the convention we report something else. Every issue will contain abundance of interesting matter for every class of reader who is interested in foundry work, pattern-making and nickel plating. These subjects can be divided and subdivided into many subjects, and our aim will be to cover them all. The July issue will contain an interesting article on Aluminum, Iron and Electron, by Wallace Dent Williams, who so ably handled the series of articles on zinc, recently published in these pages. We will also show "before and after" views of one of Canada's best foundries which has recently been renovated, showing the difference between the average shop and the one which is fit to work in. We will also show one of Canada's leading non-ferrous foundries which installed electricity for melting a year ago and which has this year doubled its melting capacity. We will always endeavor to show what is transpiring in Canadian foundries but will, of course, also keep our readers posted on what is being done in every part of the world. As an example of this we will show, in the July issue, how iron ore is melted at the River Rouge plant of the Ford Motor Co., and poured into automobile cylinders without the formality of being first poured into pig iron; how melted iron can be taken direct from the blast furnace and kept all day, if necessary, in a thermos bottle holding twenty-five ton; how this metal can be analyzed and built up to what ever chemical content is required, and still be in condition to pour high-grade work. We will also devote considerable space to the melting and working of aluminum, a subject which is, as yet, only in its infancy, but which received considerable attention at the convention.

These are only some of the subjects which will be dealt with in the next issue of Canadian Foundryman, in addition to the industrial news and letters to the editor, which are always eagerly read. Every page will be filled with interesting reading, as will the pages of succeeding numbers.

Canadian Foundryman is Canada's foundry paper, and while we cover the ground and have practically every man who could be considered as a likely prospect on our list, we have undoubtedly missed an occasional one, and if any of our readers know of a friend who is not a subscriber, he will not only be doing us a good turn, which we hope we deserve, but he will be conferring a favor on his friend by introducing him to Canadian Foundryman. The greater number we serve the better we can serve them, but while we admire patriotism and sentiment it is not on this kind of foundation that we want to build. We want our readers to feel, from a business standpoint, that they are getting good value for their money. It takes a lot of different types of mankind to make up even the foundry section of the world and we want to please them all. It is for this reason that we publish an occasional article which could be found nowhere but in a museum. There are those who like to read the history of metals from the stone age down to the present.

Market Conditions

THE CONDITION of the iron and coke market is unchanged. The coal miners' strike and the threatened railway strike, make future prices uncertain with the result that buying is done in a similar manner to what was practised during the war. Producers are not anxious to make any contracts for fear of having to fill them at a loss in case the various strikes force the prices upward, while purchasers do not want to make large purchases, as they consider that a reduction in the price is due and would come into effect if the strikes should be called off. The idea of profiteering is being discouraged, so the prices remain a fixture with neither buyer or seller wishing to do much business.

Grimsby foundry changes hands. Canada Stoves, Ltd., Grimsby, Ont., has been sold to Hamilton interests who will discontinue the manufacture of stoves but will continue to manufacture furnaces and will, in addition run a jobbing foundry business.

W. Bingley & Son, Marlboro and Race streets, East Cornwall, Ont., have purchased the foundry formerly operated by Derochie Bros. of that city and will operate it in conjunction with their regular foundry and machine shop business.

Some big castings are to be made in the foundry of the Dominion Engineering Works, Montreal as soon as the patterns are ready; the company having secured the contract for four 54 inch pumps to be installed at the Sumas Dam to chain Sumas Lake, B. C. They are to be delivered in February, 1923.

New pattern works at London, Ont. Joseph A. Oligney, formerly with "Spramotor" London Ont. and Alfred A. Henery formerly with Beatty Bros., both practical wood and metal pattern makers have opened a jobbing pattern shop at 100 York street in that city under the name of "Modern Pattern Shop."

Receives well merited promotion. A. E. Cambridge, who for some time was employed at the Toronto branch of the E. J. Woodison Co., as engineering expert, and who was recently transferred to the Montreal branch to a similar position has been promoted to the managership of the Montreal branch 261 Wellington street, Montreal.

National Castings Limited, Belleville, Ont., a new foundry which started operations in that city about a year ago with N. L. Turner as president and F. A. Daniels as manager have purchased a "Lectromelt" electric furnace from the Pittsburgh Electric Furnace Company, and will have it in operation in a short time. They will manufacture electric steel and special brands of electric gray-iron castings.

Chain Furnace Screens for furnaces and ovens are described and illustrated in a neat catalogue, distributed by E. J. Codd Co. 700-708 South Caroline street, Baltimore, Md. The screen door which is intended to protect the workman when charging the furnace consists of a multitude of freely swinging individual str nds of steel chain hanging close together from a steel bar in a manner to form a continuous sheet or curtain of chain, not unlike the familiar Japanese portiere. This curtain of chain hung before the uncovered opening to a furnace, and looking like a coat of mail, effectively hinders the heat, glare, gases and sparks from leaving the furnace and the cold air from entering. The loosely hanging strands of light chain are parted with ease and pressed aside by the tools or other objects projected into the furnace, only to fall together again and close the opening when entrance has been effected.

A new pig iron plant is to be constructed in Newfoundland by the British Steel Corporation. It is to be in running order by 1928 and is to be capable of turning out 100,000 tons of pig iron per year. The Steel Corporation will also erect coke ovens and guarantees to spend three million dollars in Newfoundland before 1926.

The new foundry being built at Port Colborne, Ont., by the company of which Albert Francis, formerly foundry manager of Canadian Engines Ltd., Dunnville, Ont., is manager is rapidly nearing completion. The buildings are up and the cupola installed and when a few finishing touches such as putting in the sash and hanging the doors are completed the plant will be ready for the production of castings. Port Colborne is an ideal site and is becoming a lively manufacturing town and should be well able to support a first class foundry.

"**Steel and iron** and their application to the cement industry is the title of a paper to be read by W. R. Shimer, sales metallurgist of the Bethlehem Steel Co., Bethlehem, Pa., at a regular meeting of the Portland Cement Association which will be held at Hotel Traymore, Atlantic, N. J. June 27th. Iron and steel are used in all modern structural work, but while it is the real strength of the structure, it is overlooked by the observer who speaks of reinforced concrete, regardless of the fact that the concrete is simply the filling material.

The Moncrief Furnace Co., Guelph, who opened their business in that city about three years ago as a Canadian branch of an American concern have decided to discontinue the business. They had a good location and intended to build in the near future, but the continued depression probably discouraged the idea. So far they had no foundry but were assembling and distributing furnaces which were cast in their American plant. This will not be a loss to the foundry business in Canada, but will be, if anything, a gain as it will remove an American competitor, in regard to the foundry department.

The Dominion Pat ern Works at the rear of 109½ Adelaide st., West Toronto, which was organized by James Joslin some twenty years ago and which was taken over by Walter Redpath in 1916 has again changed hands having been taken over on May 6th by J. H. Hodgarth formerly with the Allis Chalmers plant, Montreal, and J. Helliker, two practical pattern makers

The F. A. Coleman Co., 6539-41 Metta Avenue, Cleveland, Ohio, announce that they have purchased The Advance Engineering Co., as a going concern, and also adjacent property to provide for expansion. The F. A. Coleman Co., manufactures foundry equipment and will continue to manufacture the line of Aden clamshell buckets which the Advance Engineering Co., has been manufacturing. They will also act as sales agents for a number of manufacturers of foundry equipment who stand high in their lines.

DAVID McLAIN GOES TO ENGLAND

The fact that Great Britain arranged to have a foundrymen's convention during the same month as the American Foundrymen's Association although not during the same week, made it difficult for anyone to attend both conventions. Mr. David McLain, of McLain's system of mixing iron by analysis, who has many students and graduates in the British Isles, France and Belgium, whom he wishes to visit, has taken advantage of the occasion to visit the Birmingham conference, where it is the intention that he shall read a paper. He sailed from New York on the "Olympic" on June 3rd and was, of course prevented from attending the convention of the American Foundrymen's Associations, where he has always been a regular attendant. He was missed from his usual place, but it is hopeful that his trip abroad will be successful and that in future the dates can be so arranged that he can attend the British conventions and also the one on this side of the Atlantic.

OBITUARY

WILLIAM SHEARER

Wm. Shearer, who served for a number of years as superintendent of the James Smart Mfg. Co., died a few days ago, at his home in Brockville, Ont. Mr. Shearer has held various positions since his retirement from the James Smart Co., and in addition to being engaged in the real estate business has been secretary-treasurer of the board of trade, and held other local positions.

MRS. H. L. DEMMLER

Friends of Mr. H. L. Demmler of Wm. Demmler & Bros., Kewanee, Ill., manufacturers of the Demmler patent air operated core making machine, will learn with regret of the untimely death of his wife which took place at her late home in that city at 2 o'clock on Sunday morning, June 4th. Mrs. Demmler, who was only 51 years of age suffered a stroke of apoplexy a short time before from which she never recovered.

ERNEST SOLVAY

Ernest Solvay, the inventor, reputed to be the wealthiest man in Belgium, died suddenly at his home in Brussels on Friday morning, May 26th. Mr. Solvay will be remembered as one of those who were seized as hostages by the Germans on their entry into Brussels during the early stages of the war. As an inventor he was chiefly interested in chemical research and as such he became world famous in the metal industry field as the inventor of the "Solvay Process" of making low-sulphur foundry coke from ordinary soft coal which had formerly been unsuited. Had he accomplished nothing but this his name would be worthy of a prominent place in history.

WILLIAM YEATES

Wm. Yeates for many years one of the leading manufacturers of London, Ont., died at his home in that city on May 16th at the age of 75 years. Mr. Yeates was born at Liverpool, Eng., but came with his parents to Canada when a small boy. He served his apprenticeship as a machinist with a man by the name of David Bruce. He afterwards worked with the firm of Macpherson, Glasgow & Co. of Fingal. He was subsequently engaged in different partnerships until 1881 when he founded the London Machine Tool Company, which business he carried on nearly a quarter of a century. In 1912 this concern was absorbed by the Canada Machinery Corporation. Mr. Yeates intended to remain in retirement after disposing of his interests in this business, but the war made it a duty for him to do what he could and accordingly he rented several small machine shops and bought his castings in order to produce fifty lathes for the munition plants. This was his last venture. Many of the best molders and machinists in the business today are the products of Mr. Yeates' plants.

NEW BOOK

Galvanizing and tinning, by W. T. Flanders is a new book of 328 pages, published by U. P. C. Book Company, Inc., 243 West 39th street, New York. This book covers the subjects completely, illustrating and describing the latest methods and devices for galvanizing or tinning plates, pipes, wire, netting, trinkets, etc. Coating of metal with zinc and tin by the hot process with descriptions of the kettles, furnaces, etc. are described in the first section as are the pickling devices, acids used for cleaning, oils, fluxes, etc.

In the second section the electro-galvanizing process is clearly explained and all the mechanism illustrated. Tinplating is a different process from coating with zinc and this is thoroughly described. Metal spraying is also given considerable space. Sherardizing or dry galvanizing is an interesting process which has been known in a crude way for many years, but has only recently been systematized. This process is well written up and much matter which will be new to most galvanizers well defined. The book is written to be of practical value to the men who are actually engaged in the galvanizing plant and for those who contemplate the installation of plants.

HAMILTON AWARDS TENDERS

The city of Hamilton have awarded contracts for their annual requirements for the following:—

Grey iron castings to Hamilton Foundry Co., Hamilton, at 2.93 cents per pound.

Cast iron pipe to Gartshore-Thomson Co., Hamilton, at $62.00 per ton.

Special castings to Gartshore-Thomson Co., Hamilton, at 5 cents per pound.

Extension boxes to Forwell Foundry Co., Kitchener, small sizes at $2.00 each. large sizes at $2.85 each.

Bronze hydrants to Tallman Brass & Metal Ltd., at 23 to 30 cents per pound.

Lead pipe to Tallman Brass & Metal, Ltd. Hamilton, at 9.5 cents per pound.

Gate valves 2 in. to Kerr Engine Co., Walkerville, at $4.10 each.

Gate valves 6 in. to Drummond-McCaul Co., Toronto, at $16.50 each.

WHAT "TYCOS" ARE DOING

The following letter from the Taylor Instrument Companies of Rochester, N. Y., explains exactly what they are doing and what they expect to do in the Canadian field:

Dear Sir:

The publication of a news dispatch in the Canadian press of the purchase by Taylor Instrument Companies of the Stevenson Building, Toronto, has made current many rumors which, harmless in themselves, might create false impressions. Accordingly, we give certain facts below, in the belief that a news item in your publication based thereupon, would give the exact situation existent to-day.

A—We have just completed the purchase of the property at 110-112 Church which has been known as the "Stevenson" Building, and which will now be called the "Tycos" Building.

B—The size of our plant will come about simply from a slow development.

C—We will start in the repairing of all of the various instruments manufactured by us, and to begin with assemble certain instruments, and the extent to which we will manufacture or assemble in Canada will depend entirely upon the demand for the product.

D—We have already started in repair and certain assembling work.

E—It is impossible to say how many hands are likely to be employed, as this will be a development in proportion to the Canadian possibilities in our line.

We therefore seek your co-operation in the preparation by your editorial department and the publication in your valued medium.

Yours very truly,
Taylor Instrument Companies
H. J. Winn, pres.

STANDARD CORE PARTS

By Robert Mawson

The trend of the times in machine shop practice is to standardize the various elements used for the machines as far as possible. This practice has at least a two-fold advantage—the making of less varied elements and, as will naturally follow, the keeping for repair purposes more parts similar in design. We have recently followed the same idea in our pattern shop. It is a well known fact that if a number of patterns were made in the same shop even by the same man with an intervening length of time between them, the necessary though often considered unimportant core print would be of a different shape on the various patterns. This necessitates an excess of core boxes even for the same diameter of core which could be avoided by standardizing the core prints.

Referring to the illustration it will be seen that both taper and straight core prints are shown—to be used on the cope and drag sides of the patterns. The shank, which fits into the pattern is made of one size so that the pattern maker will not have to use different sizes of drills for various core prints—he gets used to one standard size—9/16 in. The length of the core print body is made to one ratio—namely ¾ of the diameter. I have given a list of the prints we carry in stock, but some of these could be conveniently dropped in many shops. The obvious advantage of these standard core prints is the reduction of core boxes required, only one being necessary for each diameter of core. The following of such a system will be found profitable to both the small and large machine shops or foundries.

Mr. J. J. Wilson, manager of the Hiram Walker & Sons, Metal Products Co., Ltd., new motor foundry, Walkerville, Ont., has already filled the plant to capacity, and is planning to put on temporary additions to enable him to take care of additional tonnage.

MELTING TESTS, CHANGING MACHINES DURING RUN

(Continued from page 40.)

From this table it will be observed that with perfect bed conditions in each of the four foundries, "first iron" over the spout coming in 10 minutes in each case, and with twice as much coke between the charges as need have been in ordinary practice, yet the Mayari pig iron must have melted, (and the other pig iron—also machine cast—with it) from the upper charges before the lower ones were gone. The above figures are the averages of a series of melts in each of which the regular progression of charges contained the nickel-chromium content as stated. What would have been the result had the usual 10 to 1 ratio of metal to coke been used, can only be conjectured. Melting could not have taken place within the middle of the upper charges as the only oxygen likely to be present above the melting zone would be close to the lining of the cupola. That melting does take place far up in the cupola at the lining is often observed by the foundryman when the nature of the scrap keeps the charges open. Thus, in making brake-shoes with heavy percentages of stove plate scrap, and where on occasion an entire stove finds its way into a charge iron can be observed melting a foot or two below the charging door, with the entire rim of metal red hot.

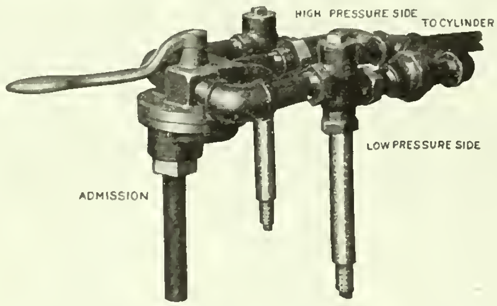
The only conclusion to be derived is that melting takes place much higher than is supposed, along the lining, and that it is of utmost importance to charge metal and scrap uniformly in their several layers, so that whether melting takes place in the upper charges or not, whatever does drop down will consist of the right proportions in the mixture. Again, that strict attention be paid to the order of charging—steel first, pig and heavy scrap next, and light scrap on top. Machine cast pig melts faster than sand cast pig of equal sections, because of the higher combined carbon in the first. Inasmuch as machine cast pig usually has a heavier section, this condition of melting usually equalizes itself.

Further, the practice occasionally met with of placing all the pig of a mixture around the rim of the charge, and the scrap in the center, cannot be condemned too severely. Cupola melting differs from all other methods in the peculiarity that intense heat is developed at the actual contact point of coke and iron. With the usual layering in charging, the proportion of coke to pig iron at the rim with the above mentioned practice, will be considerably smaller than it is in the middle, and hence coke will burn away too fast around the sides to give very hot metal, not to speak of it being oxidized. If it were not for mixing with extremely hot metal from the central portions of the cupola when the tap-hole is opened and the metal converges from all parts of the crucible, bad results would be had. As it is, many cases of alternating hard and soft castings which look sound and have blow-holes side by side, can be traced to this bad practice when other charging conditions are correct.

Therefore, it can be emphasized that with all its advantages the cupola melting process has some draw-backs, one of which is plainly shown by the tests with nickel-chromium here described. Every attention must be given the details of charging and blast conditions, so that however melting proceeds it may give reasonably uniform results.

A request to alter the method of computing the tax on company earnings has been made to the Dominion Government by the Border Chamber of Commerce of Windsor, Ont. This body asks that the tax be figured on earnings over three year periods as it is done in the United States. By this method if a firm makes $100,000 one year and loses $50,000 during the next two it would be taxed on $50,000 only.

The Walsh Plate and Structural Works of Drummondville, Que., have secured the following contracts:—Structural steel for $500,000 factory for the Dominion Silk Dyeing & Finishing Co. of Drummondville; structural steel for new warehouse of Butterfly Hosiery Co. of Drummondville; new steel penstock for Rolland Paper Co., at St. Adele, Que.; steel for new theatre at Valleyfield, Que.; structural steel for new store on St. Denis St., Montreal.



CLASSIFIED ADVERTISEMENTS

TWO CENTS A WORD, including the "Canadian Foundryman" box numbers; minimum charge is $1.00 per insertion, for 50 words or less, set in 6 point type. Each figure counts as a word. Display ads., or ads. set in border, are at card rates.

POSITION WANTED

BRASS FINISHER, GOOD ALL ROUND MAN, lathe and bench hand, plain pattern making, good knowledge of polishing and plating. At liberty July. Go anywhere. Box 704 Canadian Foundryman.

PRACTICAL FOUNDRYMAN, 25 YEARS ON light, medium, and heavy work, green and dry sand. Bench, floor and machine molding. Melt by analysis and thoroughly competent on Cupola practice. Good reference. Box 707, Canadian Foundryman. (C.3F.)

POSITION WANTED BY FOUNDRY Foreman, 25 years practical experience on Stove, Furnace, Boiler Sections. Match Plates, and Moulding Machines. Capable of figuring costs. McLain graduate, presently employed but desires change. Address Box 706 Canadian Foundryman.

FOR SALE

BARGAIN IN USED ELECTRIC FURNACE—A one-ton Volta Electric Furnace for melting steel, grey iron or Ferro alloy furnace, 220 volts, 25 cycle, 3 phase; complete equipment. For further particulars write Hiram Walker & Sons, Metal Products, Limited, Walkerville, Ont., P.O. Box 156. (c.t.f.f.)

WANTED

WANTED—A TABOR MOLDING MACHINE squeezer No. 10—34" between upright. to be in A1 condition. State price. Apply W. J. Dalgleish, 221 Dundas St., Galt, Ont.

J. & J. TAYLOR'S SAFES FOR SALE

One J. & J. Taylor Safe, inside dimensions 15 inches deep, 2 feet 6 inches wide, three feet 11½ inches high and fitted with a built in compartment. Price $250.00.

One J. & J. Taylor Safe 18 inches deep, two feet 9 inches wide, four feet 5 inches high, fitted with a steel compartment. Both safes are in good condition and can be bought at a price that will save considerable money to the purchaser. Price $200.00. Box 900, Canadian Foundryman. 153 University Avenue.

CLOSING TIME

Advertisements for this section must be in our hands on the 9th of each month.

In order that the announcements of your wants, etc., shall not be delayed, please try to have them in our office as early as possible.

CANADIAN FOUNDRYMAN

PIG IRON

(ALL GRADES)

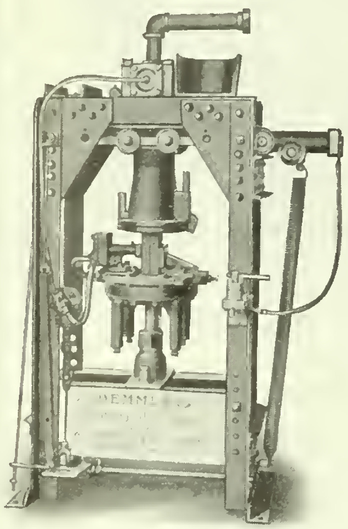
FERRO MANGANESE—FERRO SILICON

Stock and Import

A. C. LESLIE & CO., Limited, MONTREAL

DEMMLER

Air Operated Core Machine



Price $760
F. O. B.
Kewanee, Ill.

Maximum capacity, 15 boxes per minute. Average run is 5 boxes per minute. Twenty-five satisfied customers are getting good returns on investment. Cores for plumbing goods, valves, malleable, specialty plants. Easy to instal. Easy to operate.

Wm. Demmler & Bros.
Kewanee, Illinois.

MOULDING SANDS

Years of experience in Mining and Blending Foundry Sands goes into every car of sand we load, without extra charge.

GEORGE F. PETTINOS
SANDS AND SUPPLIES
PLUMBAGO FACINGS

ALBANY SAND
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SHARP SILICA SAND
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FIRE SAND
LUMBERTON SAND
SAND BLAST SAND

R. J. Mercur & Co., Ltd., Montreal
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GEORGE F. PETTINOS
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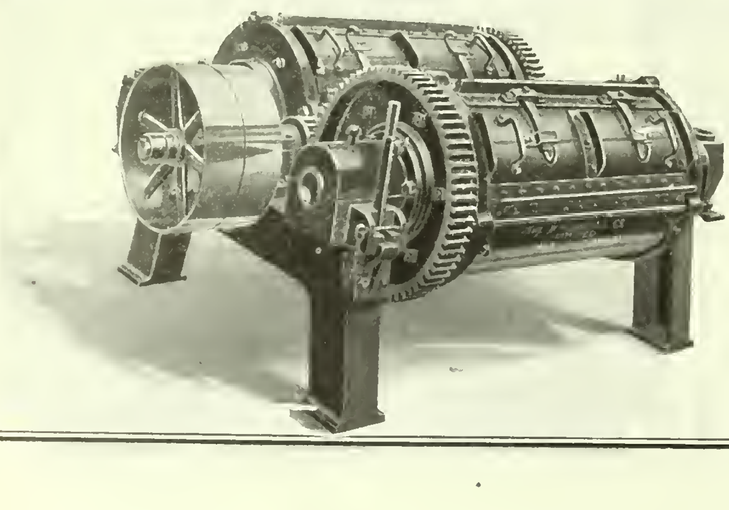

EXHAUST TUMBLING MILLS BUILT IN DOUBLE FILE

Constructed in the same efficient manner as all other McDougall products.

Each Mill may be run separately, which proves a decided advantage when filling or emptying.

Properly protected Ring Oiling Bearing.

Guaranteed for Long, Continuous, Satisfactory Service.

THE R. McDOUGALL CO., LTD.
GALT, ONTARIO

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Directory of Foundry Supply Houses

The Buyers Directory of Canadian Foundryman was originally intended to contain information regarding lines in the production of which the advertisers actually specialized. We now carry the advertising of leading supply houses, some of whom represent scores of manufacturers, in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the supply houses so we recommend that for all general requirements our subscribers communicate with the supply houses listed below:

Dominion Foundry Supply Co., Toronto, Montreal
The Hamilton Facing Mill Co., Limited, Hamilton, Ont.
Geo. W. Kyle & Co., New York
Frederic B. Stevens, Windsor, Ont.
The E. J. Woodison Company, Limited, Toronto, Ontario; Montreal, Que.

ANODES, BRASS, COPPER, NICKEL AND ZINC
W. W. Wells, Toronto, Ont.

ARGGON
Dominion Oxygen Co., Toronto, Ont.

BRASS FURNACES
Hawley Down Shaft Furnace Co., Easton, Pa.

CHEMISTS
Charles C. Kawin, Chicago, Ill.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Indiana

CORE MACHINES
American Foundry Equipment Co., New York City.

CORE OVENS
Damp Bros., Mfg. Co., Toronto, Ontario.
Monarch Engineering Mfg. Co., Baltimore, Md.
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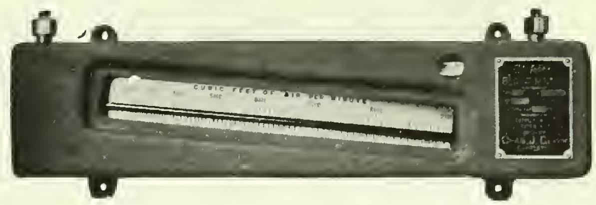

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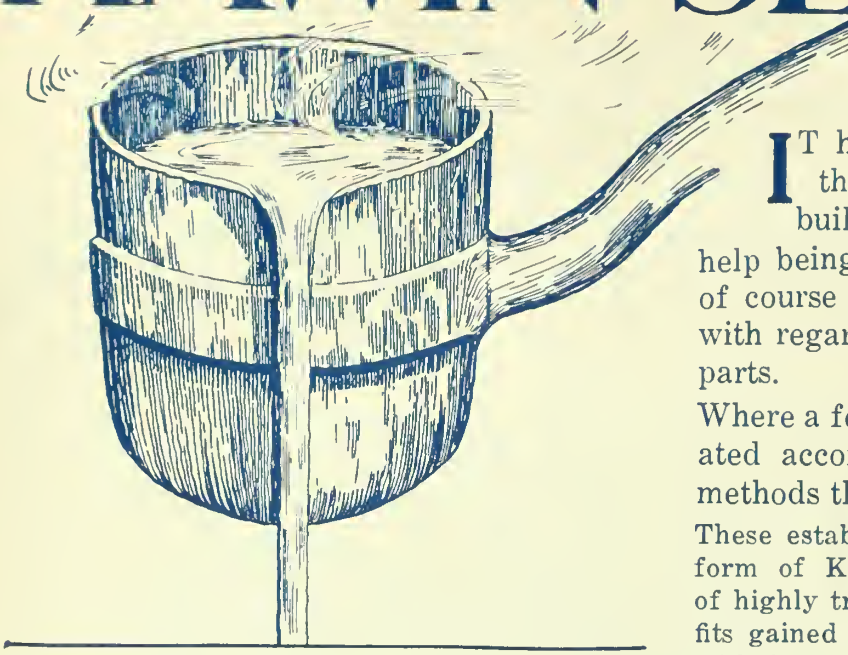
CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England.

Vol. XIII Publication Office, Toronto, July, 1922 No. 7

KAWIN SERVICE



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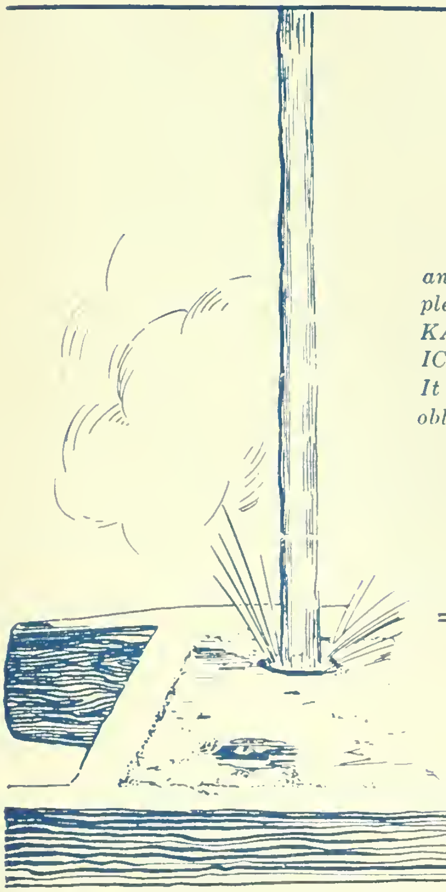

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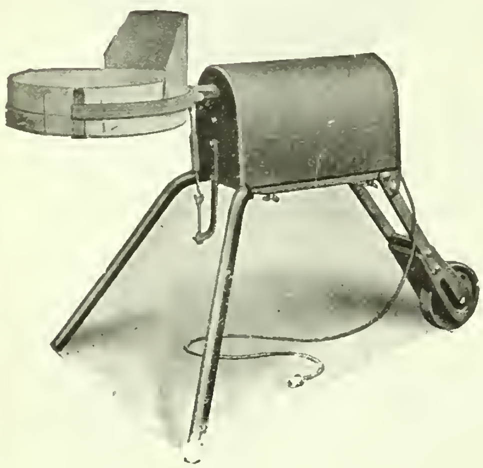

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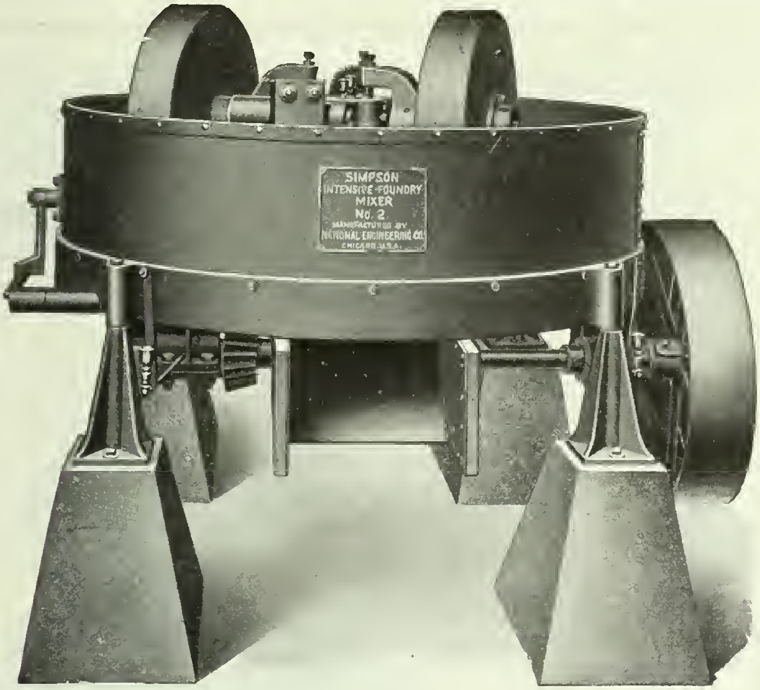

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CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Member of the "Audit Bureau of Circulations"

Established 1909
Published Monthly

Making High-Grade Castings Direct From the Ore

Ore Melted in an Ordinary Blast Furnace is Kept in a Vacuum Thermos Container Until Chemical Analysis is Taken After Which It Is Mixed With Cupola Iron

By F. H. BELL

CONSIDERABLE prominence has been given of late as well as much speculation as to the real success of the venture which Henry Ford was bold enough to undertake in making castings direct from the iron ore without first running it into pig iron. So far it is only in the experimental stage, and while not the success which has been attributed to it, it is by no means a failure and will, no doubt, ultimately be a profitable method of procedure where the tonnage is great enough.

Before describing how it is done, it will be as well to explain why the pig iron process was ever considered necessary and what has to be overcome in eliminating it. It will not be necessary to go into details in connection with the blast-furnace which separates the metallic portion from the rest of the ore, as this has been shown in these pages on other occasions. Neither will it be required that the reader should be reminded of the process of running the iron from the furnace into open molds on the floor, as this process is rapidly giving way to the more modern and sensible process of pouring into permanent molds by what is commonly referred to as machine cast. A few words will, however, be in order on both methods, and then I will endeavor to show how the direct method can be worked in.

Most every foundryman has at some time seen pig iron made but there are those who have not.

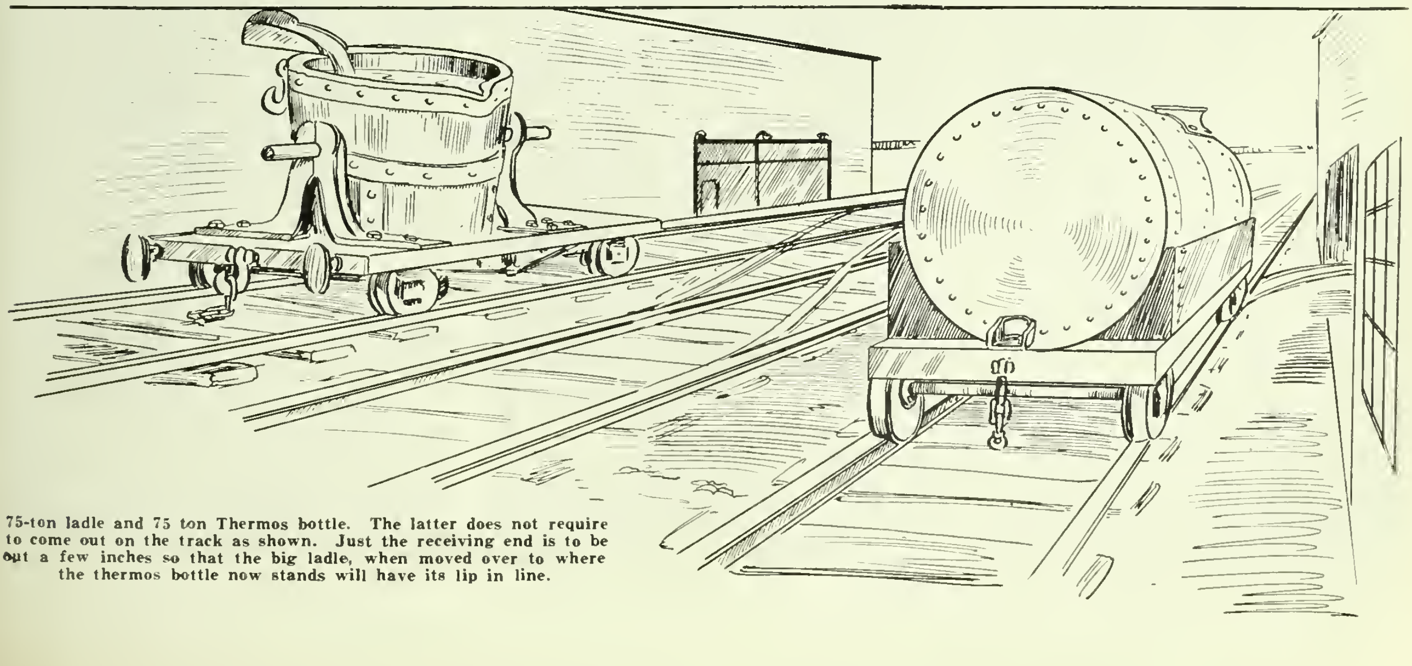
A blast furnace is similar to a cupola but on a large scale. The fuel is put in first and when melted it runs down through the fuel the same as in the cupola, but iron ore carrying such a quantity of impurities has to be handled so as to get rid of the slag.

In the ordinary pig iron plant the furnace stands in one end of the building with the spout slightly above the floor level. When tapped out the iron runs out to the floor and fills these molds which make the pigs.

When the machine came into fashion the furnace remained as it was, but a pit had to be dug in front of it to receive the ladle which is to carry the iron to the molds.

In building a modern furnace, where it is the intention to use the machine, the furnace is placed in the second story of the building. Of course it does not sit on the upstairs floor but rests solidly on the foundation which projects up through the floor. By this means the ladle which is suspended on a car can be run under the spout and removed with ease.

To demonstrate how the whole thing works out I will show a trough layout of the yard and part of the walls of the buildings at the River Rouge branch of the Ford plants in Detroit. The ore and coke and lime stone are in the rear of the furnace. This is handled the same as in common practice, the gas from the furnace being used for heating the air which is to be forced into the furnace of the plant. In front of the furnace is seen the ladle which holds approximately seventy-five tons of melted iron. This iron is the same as comes from any blast furnace, which is to say it is of doubtful analysis. Different grades of ore are mixed with a view to getting the required chemical content, but ore is never uniform, and while a good estimate can be made of what it contains every batch has to be analyzed to be sure that it is right. The least mishap in charging the furnace may make a big difference in the resultant metal. Batches of iron from a furnace have been compared to newly made violins; each one has to be played on before its value can be ascertained, but one thing which is known is that the higher the temperature, the more silicon will the metal contain and,



75-ton ladle and 75 ton Thermos bottle. The latter does not require to come out on the track as shown. Just the receiving end is to be out a few inches so that the big ladle, when moved over to where the thermos bottle now stands will have its lip in line.

of course, the hotter will the metal be when it leaves the spout, both of which characteristics are essential to the successful carrying out of the direct process.

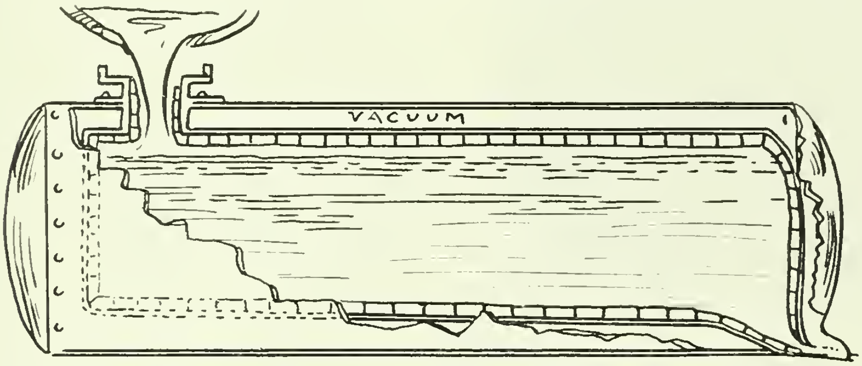
In charging the furnace, coke charges slightly in excess of the ordinary are charged on and a correspondingly higher blast pressure is necessary to penetrate through this with the result that the iron comes down white hot and high in silicon. When I say high in silicon I infer that the silicon content is greater than it would have been if furnace had been operated in the ordinary way, and when I say that the analysis is doubtful I say it knowing that while it is impossible to know in advance just what will be the result, a good furnace man knows just about what he is getting when everything is working right. But just about what he wants is not near enough, he must know exactly and for this reason the chemist must keep tab on every batch.

On the opposite side of the yard from the blast furnace is the molding shop with a complete complement of cupolas sufficient to serve the entire shop if required. Up the yard about a quarter of a mile is the pig iron casting room. When I say a quarter of a mile, I am not exaggerating. It is hard for the ordinary layman to realize that at the old Ford plant at Highland Park the molding room which consisted of one roof and four walls was nearly half a mile in length.

In front of the door of the molding shop will be seen the container in which the metal is held while the chemist is making his calculations. This container is what might be termed a thermos bottle. It consists of one shell within another, and with an air-tight space between them, the inner one being lined with firebrick. At one end is a tap hole near the bottom while at the other end and on the top is an opening into which the metal is poured from the seventy-five ton ladle. These two openings are the only spots which are ever exposed to the outside atmosphere and these are kept closed all the time excepting when it is absolutely necessary to open them. A gas burner is always in readiness if necessary to liven up the iron at these places, should it be inclined to become congealed but this is seldom required.

A certain number of cupolas are always in operation and the scrap from former heats and some pig iron together with what steel scrap or special metal it may be desired to include are melted in the cupola and mixed with the furnace iron. This metal is melted at a fairly high temperature also and the analysis is fairly well known in advance—as much so as in any other foundry. By taking the analysis of the iron in the thermos bottle as well as what is melted in the cupola it is an easy matter to figure how much of each will be required to arrive at any desired mixture. The metal which is very hot when put in the thermos bottle will remain hot for five hours if required. The metal which is melted in the cupola being scrap will be low in silicon while that in the thermos bottle as we have already seen is high in silicon. The two being mixed in proper proportions equalizes the silicon and produces just what is wanted and at the proper temperature to pour the work.

This is all there is to casting direct from the ore. When seen it is as simple as pouring ordinary cupola melted iron, but it represents an enormous outlay of money and could not be applied to a foundry of ordinary caliber.



Internal view of the receiver which I have called a Thermos bottle on account of its resemblance to this well-known lunch hour convenience.

The yard, as will be seen in the sketch, is covered with railroad tracks, one line runs along the front of the building containing the blast furnaces while another runs along the opposite building which houses the molding room and the casting machine. Running the entire length of the latter building and overhanging the railway track is a powerful gantry crane. When the blast furnace is tapped the metal runs through a winding trough of considerable length which gives the attendants an opportunity to see that any slag which escapes with the iron is switched in a different direction leaving the clean iron to run into the ladle. When ladle is full the trough through which the metal travels from the furnace is temporarily blocked up while the locomotive pulls the car along sufficient to allow another ladle to come into service when the iron is again allowed freedom to flow into it. The full ladle is now drawn away by the locomotive and delivered to the opposite side of the yard and in line with the thermos bottle. The ladle is on trunnions so that it can be tipped. This is done by hooking onto it with the crane. After sufficient metal has been poured into the thermos bottle the balance is drawn up to the pig iron department and poured into pigs.

If the furnace is required for making malleable pig or any special brand such as bessemer, etc., the foundry runs on just the same and pig iron is melted in the cupolas so that the pig iron which has been made is used and the thermos bottle is not required. There is a vast difference between the blast pressure on a pig iron furnace and that of the cupola. With the cupola the pressure is reckoned in ounces while on the blast furnace it is calculated in pounds the same as on a steam boiler, yet with all of this pressure there is nothing blows out of the stack for the reason that there are so many charges of coke and iron between the bottom and the top that there is no direct line between the bottom and top through which the blast can carry anything. The iron ore is to a great extent in the form of dust, but this is usually wet before being charged on. This keeps it intact until it is covered with the next charge. From this it will be seen that machine shop turnings can be handled to advantage. Thousands of tons of borings are produced every year in a machine shop such as Ford's and this would be next to worthless in an ordinary foundry but here they are put in with the ore and converted into good iron. The method of making pig iron by machine is an interesting invention, much more interesting than might be imagined. This will be described in the August issue of Canadian Foundryman.

OBITUARY

John MacPherson Taylor, eldest son of John M. Taylor, president and general manager of Taylor-Forbes Co., Guelph, Ont., died at his home in that city on Friday, June 30. Mr. Taylor had not been in the best of health for some little time but he had been feeling better during the last few days and was thought to be recovering. He had been about the city during the day and had spent the evening in conversation with his family, but through the night he took a bad turn and passed away before morning. He was born in Toronto in 1899. At the time of his death he was assistant to the general manager at the Taylor-Forbes plant. Besides his parents, two brothers and two sisters he is survived by his wife and four young sons.

A paper tape measure is being rolled into German bolts of cloth arriving at Montevideo, Uruguay. This innovation permits the salesman to tell at a glance the quantity of cloth remaining in the bolt, thus economizing time and labor and preserving the cloth in better condition than when unrolled and re-rolled as required in the usual method of measuring. The tape is about half an inch in width and is marked off in yards and meters.

Aluminum and Aluminum-Alloy Melting Furnaces

Review of the Work Undertaken by the United States Bureau of Mines to Decrease Metal and Fuel Losses in Melting Prepared for the Rochester Convention

By ROBERT J. ANDERSON

We have had so many inquiries lately regarding aluminum, covering practically every question which could be asked, and which the paper prepared by Mr. Anderson will effectually answer that we have decided to publish it. As it is a lengthy article it would be difficult to present it all in one issue, so we have divided it into two parts. The first installments being to some extent preliminary we can promise that the second will be more to the point and will give details of the latest developments in melting and casting this comparatively modern metal.—Editor.

IN CONNECTION with its work during the past 10 years in the prevention of waste in the mining, mineral, and metallurgical industries of the United States, the Bureau of Mines has carried out numerous investigations looking to the more efficient utilization of natural resources. In its preliminary investigations, it soon became apparent that there were large losses involved in the various operations on the non-ferrous metals and alloys; metal, fuel, and casting losses are included here. The investigation carried out by Gillett and reported in Bulletin 73 showed that the metal and fuel losses involved in brass practice amounted to about $4,000,000 per annum. It also was shown in this investigation that, if the losses incurred in the average practice were reduced to those of the best practice, about $2,000,000 could be saved annually. In another ivestigation reported in Bulletin 108, it was shown that the losses in melting aluminum-alloy borings, owing to poor recoveries on smelting, amounted to about $300,000 per annum. In a recent investigation of casting losses in the production of light aluminum-alloy sand castings, it was shown that the annual loss amounted to about $1,200,000. If these casting losses were reduced 50 per cent by eliminating the occurrence of readily avoidable defects, then a saving of $600,000 would accrue.

The preliminary investigations which had been carried out by the Bureau of Mines in the metallurgy of aluminum indicated that serious losses exist in the melting of aluminum and its light alloys. Both metal and fuel losses are large. Accordingly, it was decided to make a thorough study of the subject, and to that end the co-operation of the industry was enlisted. The detailed results of the investigation made will appear later in a bulletin prepared by the author, entitled Aluminum and Aluminum-Alloy Melting Practice in the United States. The object of the present paper is to discuss briefly the various types of furnaces used commercially in the United States for melting aluminum and its light alloys. Some general information bearing upon the selection of furnaces will be given also.

Magnitude of the Aluminum Industry

The aluminum industry has grown so rapidly since the time when the metal became relatively cheap—about 1890—that its importance cannot be appreciated other than by comparison with the other major nonferrous metals. Aluminum now stands fourth in output among the nonferrous metals, being surpassed by copper, zinc, and lead. It has been suggested by the late Prof. J. W. Richards that the world's production of aluminum will exceed that of lead by 1930 and of zinc by 1940. Whether this will transpire is problematical, but the rapidity with which the domestic industry has grown in the past 10 years has been most striking. Using the production figures for 1918, which was the year of greatest output, the world's production of aluminum was placed at 489,000,000 pounds of which 225,000,000 pounds were produced in the United States. The recovery of secondary aluminum as such or in the form of alloys in 1918 amounted to 30,100,000 pounds. It may be stated here that all aluminum is melted at least twice and most of it several times, considering a unit weight of metal. All primary aluminum from the reduction cells is remelted and cast in pigs or into rolling ingots or remelted for alloying in the preparation of primary aluminum alloys. Primary aluminum pig is remelted for casting into ingots in rolling-mill practice or remelted for the manufacture of alloys in the foundry. It may be stated conservatively that, for the purposes of this paper, all primary and secondary aluminum may be considered to be melted at least twice, and there is a melting loss each time.

In distinguishing between aluminum-melting practice and aluminum-alloy melting practice, it is necessary to point out that about 50 per cent. of the domestic consumption of aluminum is used as such while the remainder is employed in the manufacture of light aluminum alloys.

Metal and Fuel Losses in Melting Aluminum and Its Light Alloys

The loss of metal due to oxidation, (the so-called dross loss) on melting aluminum and its light alloys is large. On the basis of data reported by operating companies and of figures derived from actual tests and from other sources, the gross loss of metal resulting on remelting substantially pure aluminum may be taken as not less than 2 per cent. although extreme figures of 0.75 and 5 per cent. have been reported. This refers to the remelting of aluminum for casting into ingots, but it may be taken as an average figure for the gross melting loss for aluminum in general. The average net loss resulting on remelting substantially pure aluminum may be taken as not less than 1.25 per cent. on the basis of reported figures, allowing for the recovery of mechanically entangled metal from the dross. If dross be considered to contain 40 per cent. metallics on the average, the net loss on this basis (derived from the gross loss) would be 1.2 per cent.; this agrees well with the figure given just above. If it be considered that the metal is melted at least twice, then the average net loss of 1.25 per cent. is equivalent to 2.5 per cent for all the aluminum used as such.

In the same way, the gross loss of metal resulting in melting for the production of alloys in foundry practice may be taken as 4 per cent. on the basis of reported figures, although extremes of 1 and 8 per cent. have been given. This refers to melting in a variety of furnaces. The average net loss in the melting of alloys in foundry practice may be taken as 2.5 per cent., on the basis of reported figures. If the dross be considered to contain 40 per cent. metallics on the average, the net loss on this basis would be 3 per cent.; this does not agree well with the figures just given. The figure of 2.5 per cent for the net loss will be used here. If it is considered that the metal is melted twice, then the average loss of 2.5. per cent. is equivalent to 5 per cent. on the gross melt.

In regard to the fuel losses incurred in melting aluminum and its light alloys, the data which have been made available through the present study, while not all that could be desired, have been sufficient to indicate low fuel efficiencies on the average. It can be shown by detailed calculations that if all the available heat units in a fuel were utilized, that is, if the furnaces operated at 100 per cent. efficiency, it would require the following amounts of different fuels to melt 100 pounds of aluminum and superheat it to 800 degrees Cent. for pouring: Approximately 4 pounds of coal or coke; 2.7 pounds or 0.35 gallons of fuel oil; 57 cubic feet of natural gas; 86 cubic feet of illuminating (city) gas; and other fuels in proportionate amounts. The fuel consumption in melting aluminum and aluminum alloys is considerably greater than in melting brass and bronze, as may be shown by a comparison of the preceding figures with those for brass in general. Thus, H. W. Gillett in Bureau of Mines bulletin 73, 1916, has given the following figures for the amounts of different fuels required to heat 100 pounds of brass to the pouring temperature: About 2 pounds of coal or coke; 1.4 pounds or 0.18 gallon of fuel oil; 26 cubic feet of natural gas. The actual limits as to fuel consumption as reported by various plants during the present investigation were as follows: 50 to 200 pounds of coal or coke; 0.54 to 15 gallons of oil, and 150 to 1,000 cubic feet of natural gas or artificial gas. In practically all instances, it was found that tremendous amounts of fuel were being consumed and that the furnace efficiencies were extremely low. It is doubtful that the average fuel efficiency in aluminum and aluminum-alloy melting furnaces can be more than 5 per cent of the theoretical.

Monetary Values of the Losses in Melting

Turning now to the question of the monetary losses incurred in aluminum and aluminum-alloy melting practice, figures have been derived for these values as applied to commercial practice in the United States. Reverting to the data given above as to the net losses incurred, it was stated that these were 2.5 per cent for aluminum and 5 per cent. for the light alloys, on the gross melt. The following figures may be considered:

	Pounds
Total consumption of primary aluminum	225,000,000
Total aluminum used as such	112,500,000
Total aluminum used for alloys	112,500,000
Net loss (2.5 per cent.) in.. melting aluminum	2,812,500
Net loss (5 per cent.) in melting aluminum alloy	2,812,500
Total loss	8,437,500

Allowing for extra meltings and the melting of borings, drosses, and other scraps, it may be considered that the net loss is about 9,000,000 pounds of aluminum per annum. On the basis of a $0.33 metal market, the total monetary loss may be placed at $2,970,000 per annum. Setting aside any consideration of the additional losses on melting owing to furnace inefficiencies, overhead, and labor charges, it is evident that, if the present net losses could be reduced 50 per cent., then a saving of about $1,500,000 per annum would accrue. Probably, $2,000,000 per annum could be saved if the fuel and other losses were considered on the basis of similar improvements. However the calculations be made, it is certain that if the average practice were raised to the standard of the best practice very great savings, at least of the order of those just given, could be effected.

Types of Furnaces Used Industrially

The problems involved in melting metals and alloys are complex, and as a whole the subject is often more difficult of investigation and treatment than problems of a purely scientific character. At the present time, the selection of the correct type of furnace for a given set of operating conditions is made especially difficult by the multitude of different types of furnaces extant and more particularly by the lack of comparable data regarding each one. Also, the selection of the furnace must be governed by the requirements of the plant, and it is not possible to state that there is any one best furnace. T. H. A. Eastick in The Metal Industry has enumerated a number of factors which govern the kind of furnace to be installed for brass melting, and these will bear repetition here. the factors are: (1, the metal or alloy to be melted, its melting point and casting temperature; (2) the number of different alloys in use and the production of each per day; (3) importance of the possible contamination of one alloy by another; (4) kind of scrap used, its character, size and shape; (5) foundry or other practice; (6) continuous or intermittent operation; (7) size and weight of the castings made; (8) physical characteristics of the shop and the neighborhood where the work is done; (9) kind of fuel in use in quantity for other furnaces in the plant; and (10) accessibility to coal, gas, oil, and electric power. This list might be extended considerably, but a sufficient number of items have been given to indicate the necessity for carefully studying all requirements and conditions before installing any melting equipment.

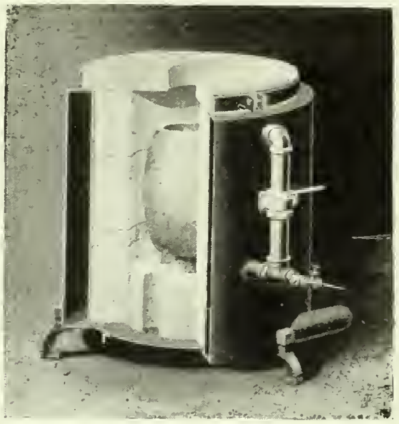


Fig. 1.—Stationary type of crucible furnace.

Referring especially to melting furnaces for aluminum alloys, it may be said broadly that in foundry work the practice has followed along the general lines of brass melting, probably because aluminum alloys have been cast largely, in the past, in brass foundries. Light aluminum alloys are, or have been, melted in practically all types of furnaces used for brass and bronze; the iron-pot furnace, so widely used for the melting of so-called white metals, is the only furnace employed for aluminum alloys, that is not used for brass and bronze. Actually, a great variety of types of furnaces are in commercial use for melting aluminum and its light alloys, and, broadly speaking, there can be said to be no thoroughly standardized mode. The reason for this is not hard to find. The aluminum industry is relatively young, and commercial melting methods are in the course of development. The type of furnace employed depends upon whether aluminum or one of its light alloys is being melted, as well as whether, in the case of aluminum, the metal is melted simply for re-pigging or for casting into rolling ingots, and, in the case of the light alloys, whether they are to be poured into sand castings or used for the production of die or permanent-mold castings or are poured into rolling ingots. The smelting of aluminum-alloy borings and related aluminum-bearing scraps presents a distinct problem, and various types of furnaces are used for this pupose.

Furnaces in Rolling-Mill Practice

When speaking of furnaces for melting aluminum, it will be generally understood here to refer to melting prior to casting into rolling ingots, although, of course, all direct metal from the reduction cell is remelted and either cast into rolling ingots or poured into pigs. Various types of furnaces have been employed for remelting the reduction-cell metal, but, in the United States, openflame reverberatory type furnaces, fired by coal, oil or gas, appear to have been employed principally. A large rectangular Bailey type electric furnace was once used by the Aluminum Co. of America at its Massena, N.Y. plant for this purpose. Melting substantially pure aluminum prior to casting into ingots for rolling or other working, reverberatory-type furnaces are largely employed in the United States, England, Japan, and on the continent. In the United States, the coal-fired reverberatory furnace appears to have been used principally, but, in more recent years, gas and oil have been used as the fuel in these furnaces.

More recently, rotating open-flame gas-and oil-fired furnaces have found favor in some small rolling mills for aluminum melting. The employment of the reverberatory-type furnace in rolling-mill work has been found necessary because large capacity is required and further because continuous melting is desirable. The question of fuel selected has been found necessary because large capacity is required and further because continuous melting is desirable. The question of the fuel selected has been decided, in some installations, on the basis of actual fuel costs and availability, while in others it appears that coal has been employed arbitrarily with little thought of its applicability. The use of gas-fired reverberatory furnaces in rolling mill practice has been described by the author in *Chemical and Metallurgical Engineering*. The use of the Bailey-type electric furnace for melting aluminum has also been described in the same journal by D. D. Miller. For melting aluminum alloys which are to be rolled, the reverberatory furnace is generally preferred, but crucible melting has also been employed.

Greatest variety of types of furnaces is employed in foundry practice for melting light aluminum alloys. Thus, the following types of furnaces are at present in daily use in the aluminum foundries of the United States: Coal, coke, oil and gas-fired reverberatory furnaces; oil and gas-fired stationary and tilting iron-pot furnaces; coal and coke-fired natural and forced draft pit furnaces, using a crucible; oil and gas-fired stationary and tilting crucible furnaces; oil and gas-fired, open flamed tilting, rotating, and stationary furnaces; and electric furnaces of various types. The stationary and tilting iron-pot furnaces are favored in the United States, particularly by large foundries, but open-flame furnaces are being used more widely now than a few years ago. In small foundries, and in foundries where only a minor part of the output is in light aluminum alloys, pit or crucible furnaces are used largely. Electric furnaces for melting light aluminum alloys are just now receiving considerable attention, and a few installations have been made.

The tendency toward the employment of furnaces of large capacity, such as reverberatory furnaces, open-flame barrel-shaped furnaces, and electric furnaces, has been quite marked in recent years and has come about through the enlargement of plant capacity. Where a foundry is turning out 5,000,000 to 25,000,000 pounds of finished castings per year melting in units of small capacity requires many furnaces. One of the commercial open-flame barrel-shaped furnaces can melt at least one ton of metal per hour and the advantage of operating units larger than crucibles or iron pots is apparent in foundries where the daily output amounts to thousands of pounds. Descriptions of most of the types of furnaces which are used in foundry practice have appeared in the technical press, and some detailed data with regard to their performance will be given later in this paper

Furnaces for Smelting and Refining ent-Mold Casting Practice

In modern aluminum alloy die-casting practice the alloys are melted in small cast-iron melting pots which may be considered part of the die-casting machine proper. The fuel usually is gas. In both die-casting and in permanent-mold casting work, it is standard practice to make up the alloys in an alloying furnace and run them into small pigs. The prepared alloys are then delivered to the die-casting machine for remelting. Stationary iron-pot furnaces are preferred for alloying in the United States, although several other types have been employed. In the case of permanent-mold casting practice, small iron pots fired by gas are preferred for melting the alloys prior to casting.

Furnaces for Smelting and Refining

In the case of smelting and refining furnaces for aluminum and light aluminum alloy borings, scraps, and drosses, the domestic practice is not standardized, and many different types of furnaces are employed commercially. For smelting borings and other light scraps for the production of so-called "casting aluminum," and making secondary aluminum and aluminum alloys, stationary iron-pot furnaces, reverberatory furnaces, pit furnaces, and open flame tilting and rotating furnaces are employed. Strictly speaking, furnaces that are used for running down borings, drosses and other high aluminum-bearing scraps should not be called "refining" furnaces, since no actual refining of the materials is accomplished.

The primary object in smelting aluminum and aluminum-alloy scraps may be two-fold; (1) simple remelting for the purpose of pigging clean choice scrap; and (2) obtaining high recoveries on dirty borings and poor grade scraps. The furnace to be employed should be governed by the kind of material smelted—at least to a certain extent.

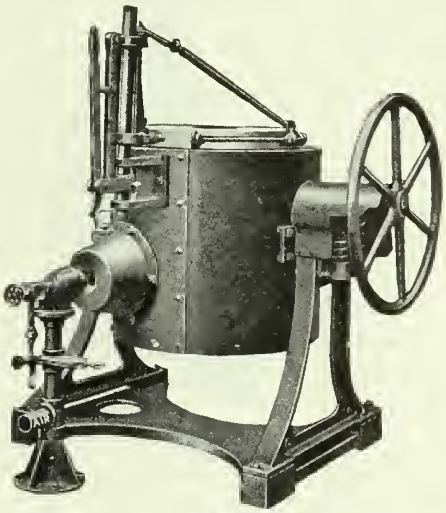


Fig. 2.—Tilting crucible furnace, similar to stationary type.

Furnaces for Making Intermediate Alloys

Intermediate copper-aluminum alloys and other so-called hardeners for use in foundry practice have been made in various types of furnaces. Generally speaking, the stationary iron-pot furnace is preferred for melting the aluminum in the manufacture of say 50:50 copper-aluminum alloy, the copper being melted either in pit or in crucible furnaces. Of course, furnaces other than the iron-pot type are used for melting the aluminum in the preparation of these alloys. In cases where intermediate alloys are made of aluminum and a metal of very high melting point, such as nickel, cobalt, ro manganese, an electric furnace may be advantageously employed. A small Rennerfelt-type eletric furnace has been employed commercially for this purpose. The Detroit-type rocking electric furnace has been used for melting aluminum bronze turnings to which aluminum was subsequently added for the manufacture of 50:50 copper-aluminum alloy.

The type of furnace employed depends, of course, largely upon the personal choice of different foundrymen and the amount of metal to be melted. Taking the cases of 60 representative plants reporting to the Bureau of Mines, 16 reported the use of stationary iron-pot furnaces, while two used tilting iron-pot furnaces. Two used tilting crucible furnaces, and 19 employed stationary crucible furnaces. Pit furnaces were reported in operation at the largest number of plants, 29 such installations being stated as in use, but it is to be remembered that this type of furnace is generally used in jobbing shops and in small foundries devoted principally to brass and bronze. Six plants reported the use of pear-shaped open-flame tilting furnaces, and one plant the use of a barrel-shaped, open-flame furnace. The use of reverberatory furnaces was reported by three plants, and three plants reported the use of electric furnaces of different types. The foregoing refer especially to furnaces for foundry work. Omitting here the pit furnaces, where a plumbago crucible is used for melting, it may be said, on the basis of the information furnished that the stationary iron-pot furnace and the stationary crucible furnace are the most favored types for melting light aluminum alloys.

Pit Furnaces

Aluminum alloys are still melted in the usual types of brass pit furnaces, particularly in small foundries devoted principally to brass and bronze. Under some classifications, there are included under pit furnaces all kinds of furnaces, irrespective of the fuel employed, where only a single crucible is used in the furnace, where the melting is done in the crucible and that crucible is used for pouring the metal. Natural-draft and forced-draft coke and coal furnaces are usually built in an actual pit below the floor level; so-called pit furnaces, fired by oil or gas, usually are not, although they may be. The latter are generally referred to as crucible furnaces in contradistinction to actual pit furnaces fired by coal or coke, and they are so referred to in this paper.

An idea of the construction of pit furnaces can be given in a few words. In the case of natural-draft pit furnaces, fired by coal or coke, a usual form of construction consists of a pit about 6 to 8 feet wide and the same depth and of varying length depending upon the number of furnaces. The pit is ordinarily divided in two, about half the width being used for the setting of the furnace and the remainder for the runway which is used for removing ashes. The latter is covered either with an iron grating or with iron plates. The individual furnaces are built side by side in the pit and supported on steel girders set about 3 to 4 feet down in the pit. Grate bars, which are usually hinged, make up the bottom of the individual furnaces. Any fuel or ash on the grate bars may be dropped into the pit below by control chains which run to the floor above. At the rear of each furnace, there is a square rectangular flue leads to the stack. In melting, the crucible is set on the fuel previously placed on the grate bars, and additional fuel is placed around the sides of the crucible. Each hole is covered with some kind of a cover, usually a dome- or flat-shaped cover which may be swung aside or otherwise readily removed. The construction of pit furnaces using forced draft is substantially the same as that of the natural-draft furnace, but the ash pit is enclosed so that air may be forced into it instead of being open to the air.

In American practice, pit furnaces are in use in foundry practice for melting aluminum alloys, taking from Nos. 40 to 400 crucibles, although Nos. 60 and 80 are the most common sizes. The two latter hold about 60 and 80 pounds of No. 12 alloy, respectively. These furnaces are lined generally with a 4-in. thick lining of good grade fire brick. Most pit furnaces are fired by coke, although both bituminous and anthracite coal are used, and natural draft is most frequently employed. In actual commercial installations, from one to eight furnaces are handled per furnace tender, and from 37 to 900 pounds of metal are melted per hour, as reported. The fuel consumption in pit furnaces is very variable, reported figures varying from 50 to 200 pounds of coal or coke per 100 pounds of alloy, equivalent to furnace efficiencies of from 2.3 to 8 per cent. In general, the fuel efficiency of the pit furnace is quite low. Melting costs for fuel in these furnaces may be taken as ranging from $0.16 to $0.55 per 100 pounds of metal melted, with coke at $6.50 per ton. As reported to the Bureau of Mines, from one to six heats are taken from pit furnaces per day, and the melting period varies from 30 minutes to two hours, depending upon the size of the charge. This is equivalent to a melting time of from one to four hours per 100 pounds of alloy. Roughly, a pit furnace, fired by coke, should give at least six heats of 100 pounds per 9-hour day with an average melting period of 75 minutes.

The life of linings in pit furnaces varies from four to 24 months, equivalent to 400 to 1,800 heats, with an indicated average of 1,000 heats. The life of crucibles in pit furances varies from 28 to 100 heats as reported, with an indicated average of 42 heats, equivalent to about 2,500 pounds of metal. The gross melting loss in pit furnaces varies from 2 to 3 per cent., as reported, with an indicated average of 2.3 per cent. The net melting loss, assuming recovery from dross and skims, may be taken as about 1.4 per cent. On the whole, pit furnaces may be regarded as fairly satisfactory for melting aluminum alloys from the standpoint of melting losses, but they are slow in operation, troublesome to handle, and exceedingly inefficient as to fuel. Taken by and large, the pit furnace is not a suitable furnace for aluminum-alloy melting in foundry practice, in the opinion of the author.

Stationary crucible furnaces are used to a considerable extent for melting light aluminum alloys in foundry practice. They are fired by oil or gas. In distinguishing between pit furnaces, using a crucible for melting, and stationary crucible furnaces, for the purposes of this paper, there are included here, under the latter, all furnaces where a plumbago crucible is set in a furnace made by lining an iron shell with refractory material, The shell may be set down partially in the pit, or it may be above the level of the floor; usually it is above the level of the floor and built as a separate unit. The capacity of the usual stationary crucible furnace is small. These furnaces are built to take up to No. 600 crucibles, but Nos. 60 to 100, with capacities of from about 60 to 100 pounds of No. 12 alloy are the most common sizes. The general principles that govern the most economical size of crucibles, as laid

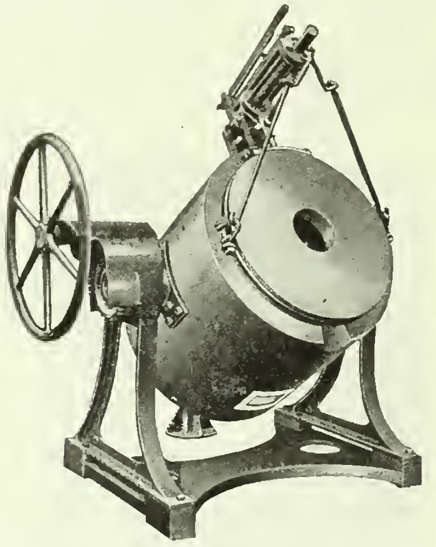


Fig. 3.—Crucible furnace, same as Fig. 2, tilted as in pouring.

down by Gillet for brass melting, apply in the melting of light aluminum alloys. Crucible furnaces are run on intermittent heats, and usually the melting crucible is employed also for pouring. After the charge is melted, the crucible is lifted out of the furnace and taken to the molds, and the metal is there poured. In stationary crucible melting there is ample opportunity for the products of combustion to come into contact with the alloy during melting, and contamination from the products of combustion may occur that would not be possible in iron-pot melting.

In the ordinary stationary crucible furnace, the crucible is heated over its exterior surface by the combustion of the fuel, and the waste gases are discharged through a hole in the furnace cover. The flames are projected into the furnace tangentially so that they are given a rotary and upward motion around the crucible, and the incandescent gases are in intimate contact with the alloy during melting. The design of the usual stationary crucible furnace is extremely simple. The ordinary furnace consists simply of a sheet steel shell, cylindrical in shape, lined with refractory fire brick. One burner, set near the bottom of the furnace and leading into the interior through a hole in the shell and lining, is employed ordinarily. The melting crucible is set on a refractory block or stool placed on the bottom of the furnace. The details of design vary considerably among different furnace makers. Some stationary crucible furnaces are built with grate bars below so as to take solid fuel, but this type is not employed to any extent for melting light aluminum alloys. Fig. 1 shows the Monarch-type stationary crucible furnace.

In American practice, stationary crucible furnaces are generally small units, and such furnaces are installed usually in foundries of small output as single units. They are rarely run in a battery in aluminum-alloy foundry practice. The capacities are greatly variable, Nos. 25 to 150 crucibles being reported, of which the most common sizes are Nos. 60 and 90. These furnaces are lined generally with a 4-inch lining inside the furnace shell. Cast-iron, fire brick, and molded clay covers are used on crucible furnaces, the last two having generally a hole in the centre for the escape of the combustion products. Both oil and gas are used for fuels in these furnaces, oil being the more common. Details of the burners used and the air supply cannot be gone into here, but briefly, most of the commercial furnaces use low-pressure air. In actual installations, from one to three furnaces are handled per furnace tender, and from 110 to 200 pounds of metal are melted per hour, as reported. The fuel consumption in stationary crucible furnaces is variable, reported figures varying from 0.54 to 15 gallons of fuel oil per 100 pounds of alloy, equivalent to furnace efficiencies of from 2.3 to 4.8 per cent. On the whole, the fuel efficiency in stationary crucible furnaces is low, and the exceptionally high efficiency reported is open to question. As a rule, on the basis of reported figures the fuel consumption in these furnaces will vary from 10 to 15 gallons of oil per 100 pounds of No. 12 alloy, with an average melting cost for fuel of $1.

From five to 12 heats per nine-hour day are taken from stationary crucible furnaces in practice, and the melting period varies from 30 minutes to one hour, depending upon the size of the charges. This is equivalent to a melting time of from 45 minutes to three hours per 100 pounds of charge. Roughly, a stationary crucible furnace, fired by oil, using a No. 100 crucible taking about 100 pounds of alloy, should give at least seven heats per hour. The life of linings in stationary crucible furnaces varies from three months to two years, equivalent to 150 to 9,000 heats, with an indicated average of 3,000 heats. The life of crucibles in stationary crucible furnaces varies from 18 to 100 heats, as reported, with an indicated average of 49 heats, equivalent to about 2,900 pounds of metal melted. The gross melting loss in these furnaces varies from 1 to 6 per cent., as reported, with an indicated average of 3.6 per cent. The net melting loss may be placed at 2 per cent. On the whole, crucible furnaces, both stationary and tilting, may be regarded as fairly suitable for melting light aluminum alloys in foundry practice, for some purposes but they are quite inefficient as to fuel, and the melting losses are rather high.

Tilting Crucible Furnaces

Tilting crucible furnaces are used to a small extent for melting aluminum light alloys in foundry practice; they are fired usually with oil or gas. In distinguishing between tilting crucible furnaces and tilting iron-pot furnaces, both types are similar in design, but in the former a plumbago crucible with a molded pouring lip is used. The tilting crucible furnace consists of an iron shell lined with refractory material; it is set on trunnions and fitted with the necessary tilting mechanism. The small units employed for melting aluminum alloys are always tilted by hand. The crucible is suspended from the top of the furnace so that it hangs down in the interior, and the crucible is heated over its exterior surface by combustion of the fuel. Tilting crucible furnaces are built by a number of makers, but the general features of design are about the same.

The capacity of the usual tilting crucible furnace is small, a No. 80 crucible being used considerably in foundry practice. These furnaces are built in various sizes to take up to No. 600 crucibles, but extreme sizes, either large or small, are not used commercially. Tilting crucible furnaces are generally run on intermittent heats, although the practice of using a molten heel may be followed. When a charge is melted, it is poured into ladles or pouring crucibles for casting into molds.

The products of combustion may, or may not, have an opportunity to come into contact with the alloy during melting, depending upon the design of the furnace. Generally speaking however, there is more or less opportunity for the combustion products to pass over the surface of the liquid alloy during melting; this can be eliminated, on the other hand, by changing the design. In most tilting crucible furnaces, the products of combustion are discharged from a broken annular ring around the top of the crucible and thence through a hole in the furnace cover. If the waste gases were led out through a vent in the side of the furnace, the possibility of gases coming in contact with the alloy would be prevented. The method of firing both in crucible furnaces and in iron-pot furnaces is generally the same when gas or oil is used. Some of the tilting crucible furnaces put upon the market by furnace makers are built in 1,000 pounds of No. 12 alloy, but these quite large sizes—to hold up to about large furnaces are not used commercially for aluminum alloys. The details of the constuction of tilting furnaces are essentially the same as for stationary crucible furnaces. Tilting crucible furnaces using solid fuel have been employed for melting light aluminum alloys in foundry practice, but only to a small extent. Fig. 2 and 3 are tilting crucible furnaces.

Scant data are available as to the performance of tilting crucible furnaces on aluminum alloys under foundry operating conditions, but in general the data given above as to stationary crucible furnaces apply here.

WILL INDUSTRIES HEREAFTER LOCATE IN RURAL DISTRICTS

"What would you give, Mr. Manufacturer, if you could have a steady supply of labor at your busy season, out of your way in slack times, always consisting of the same contented personnel, and living happily on an income that is not entirely derived from you? Wouldn't that be a fairly satisfactory state of affairs?" asks The Industrial Digest, New York.

"But perhaps your labor problem has already been solved," the magazine continues. "Perhaps you are so much luckier than the rest of us that you can always get the right kind of hands at the right price whenever you want them. In that case you needn't bother to read this article, which is a discussion of a visionary scheme for helping cure the labor troubles of American industry, and at the same time help solve the farm problem, the problem of city congestion and perhaps a few more of the difficulties of civilization.

"The author of the idea is Henry Ford. Mr. Ford's mind is productive of many ideas for the solution of the world's troubles. Not all of his schemes are regarded highly. But in discussing any idea of his relating to the labor problem it is worth while to remember that Mr. Ford is a highly successful manufacturer, and that his record for success with his labor is hard to beat.

"Mr. Ford's scheme is this: Let us combine factory work with farming. Let us locate our plants in country neighborhoods, and encourage our employees to own and operate farms. With the aid of modern mechanical methods they will be able to finish their agricultural duties in a short period every year, and they will have the rest of their time for factory labor. They will thus be stably attached to the plant, able to make a part of their living outside the factory, and relieved of the monotony of continued work at one job.

"Is it feasible to locate industry in the country? Why not? A factory must, in most cases, be on a railroad and conveniently located in regard to its sources of raw materials and its market; but these conditions can be, and often are, fulfilled in locations near good farm lands.

"When large corporations create towns in which their workers can live they usually encourage the men to cultivate little garden plots behind their houses. There is a great difference of course between a garden plot and a farm, yet to urge workers to grow their own cabbages is a step, however small, in the direction of Mr. Ford's ideal condition.

"If that condition could be made to prevail, it would be wonderfully beneficial for all hands. It would mean satisfied, cheap labor for the manufacturer and a fuller happier existence for the combined farmer and factory worker. It is a vision for the future, and most of us have all we can do to take care of the present; yet if we are to make the most of the present we must keep the future, too, in mind. Mr. Ford's idea may or may not be practical. It is at least worth thinking about."

NATIONAL SAFETY COUNCIL MEET

The National Safety Council which is a co-operative organization of men, industries and communities interested in the prevention of accidents, will hold their eleventh annual safety congress at New Cass Technical High School, Detroit, Mich., from August 28 to Sept. 1, the programme being now complete. On July 15, a printed copy of the entire week's session, together with a formal invitation from the Detroit Safety Council and supplemented by a personal letter from president Arthur H. Young, calling attention to the points of greatest interest during the five-day programme will be sent to 150,000 executives and safety men representing supervision over six million and more workers in the United States and Canada.

Indications now are that the 1922 Safety Convention will be the largest and most complete in the history of the National Safety Council. Never before in the history of the organization has response to invitations to participate in the annual safety congress been so spontaneous, public officials, industrial executives, well-known authorities in research, science and education, have volunteered to appear on the programmes to do their bit for national safety.

Complete discussion of the various phases of industrial and public safety will be had at the meetings of the twenty different sections into which the council's activities are divided. These meetings will cover safety problems in the automotive, cement, chemical, construction, metals, paper and pulp, packers and tanners, rubber, textile, woodworking, electric railway, public utilities, steam railroads, mining, public safety, educational, engineering, drop forge, health service and women in industry divisions.

The Ford Motor Company has extended an invitation to all attending the congress to visit the huge Highland Park plant of the company where 46,000 employees turn out 5,000 care daily.

While the council's activities are divided into twenty sections, one of these in particular, that pertaining to metal industries, will be of interest to foundry-

(Continued on page 26)

Discussion on Paper "American vs. British Iron"

Written Contribution to the Above Discussion on F. J. Cook's Paper by Horace J. Young, F.I.C. Chief Chemist, the North Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne, Eng.

MR. H. J. YOUNG, F. I. C., wrote that he agreed with Mr. Cook in his opening statement that "The average British engineer considers that American grey cast irons of their respective class are inferior in physical properties to those of Great Britain."

The writer thinks Mr. Cook has been generous in the way he has put it. After all it is a scientific matter, not a personal one, and it does nobody any harm to be plainly told that they are not doing quite so well as they appear to believe. As a matter of scientific fact American foundry literature frequently, nay, commonly, talks about very ordinary results as if they were things a little marvellous. Britishers have plenty to worry about and plenty to learn from America but on this particular point the American has something to learn from us.

Over in England we have two schools of thought upon the subject of what causes good tests. One of these schools puts forward the theory that some pig irons possess unalterable properties which are inherited by the cast iron made from them, while the other school of thought will not admit this— as a practical proposition affecting practical work—without scientific proofs. Mr. Cook, as is evident from his paper, belongs to the former school while the writer belongs to the latter.

Let America hesitate before adopting and applying this doctrine of inherent properties. Let her demand substantial and tangible evidence of it. As a scientist I put forward the following statement as one which cannot, I believe, be scientifically controverted: "In this country there are a good few people who will argue unendingly upon the existence of inherent properties in this or that, generally nameless, pig iron but never yet has anyone put forward a full record of many heats of two grey cast irons of precisely similar ultimate composition, one iron giving high tests and the other low tests, with nothing to account for the difference save some inherent property in one or more of the pig irons used in the mixtures.

Few people appear to realize that a research on these lines would be a very large piece of work. The writer frankly admits, after eleven years of iron-foundry practice, that he does not, at the moment, see how to set about it.

He has tabulated records of the ultimate anaylses of several thousands of test-bars and out of all that number he has not yet found two bars of precisely similar composition—this is speaking only of combined carbon, free carbon, silicon, phosphorus, sulphur and manganese and is not taking into consideration the many other elements which could be estimated, apart from those which could not. Hence it is well to thoroughly absorb the fact that it is amazingly difficult to produce two cast irons of precisely similar ultimate composition, and it may be coupled with another fact, namely, that the correct analysis of cast iron is one of the most difficult problems in analytical chemistry.

It may be taken as proved that very seldom indeed do two test bars of cast iron possess precisely similar compositions; rarely ever, if they are cast from the same ladle; hardly ever, if they are cast with surface metal; probably never, if they are cast from different ladles or different mixtures.

A further difficulty, and an enormous one, is that of melting and casting two mixtures of iron under precisely similar conditions. The writer has for some months worked a cupola, with trained assistants standing at every point with every possible control apparatus and indicating instrument, yet he could not guarantee tomorrow to get precisely the same results from the same mixture of iron as he got last week—the word "precisely," as used here, must necessarily be taken to indicate such precision as will satisfy the requirements of scientific research.

How can one measure, far less control, the volume and pressure of air passing into the cupola every minute of the run? What instrument will accurately measure air passing at the rate of that of the air supply to a cupola?

Again, how can one control the height of the bed from the beginning to the end of the blow?—control it well enough for average works purposes, perhaps; but well enough to say with scientific accuracy that on each occasion it remained the same throughout, no.

Atmospheric conditions must be taken into serious account, direction and strength of wind, barometric pressure, aqueous vapour saturation and temperature of the air—all of which are important matters and probably account in no few cases for the mysterious times when the foundryman says "my cupola is working slow, or cold, or hot or fast today."

The rate of passage and the length of passage of the molten metal through the incandescent coke are very vital factors. One pig iron, by reason of no inherent properties, may behave differently to another pig iron and by so doing gives mysteriously different results. Such results may be, and very often are, caused by different size pieces of metal, by a difference in the condition and nature of the surface or in the amount of surface area, or in the way the pig iron was cast; also by the amount of combined carbon and of graphite and finally by its general composition.

The effects of temperature, time, mass and composition during the period the metal is standing in the ladle are very vital things almost impossible to control. It will be found that test bars cast with metal taken anywhere near the surface of the ladle have never the same ultimate composition as that of the main mass of metal in the ladle. The author possesses hundreds of analyses of test bars cast-separately-from-the-main-castings compared with test bars cast-attached-to-the-main-castings; in no instance are comparisons or the physical tests of the one comparable with or relative to the other. The test bars cast-separately, from the metal near the surface of the main ladle, differ most fantastically and their composition cannot be accurately predicted. It has long been the writer's opinion that the greatest stumbling block to America's progress in ordinary grey cast iron is their tapered test bars cast-separately.

Control of casting temperatures and of cooling conditions present other difficult problems and it would be possible to go on enumerating further difficulties without serving any further purpose It should, however, be evident to everyone that proofs of the inherent properties of pig iron are lacking as indeed are proofs of many of the things that we believe, or disbelieve, about grey cast iron.

For years the writer has used any and every pig iron that has come his way, choosing them by composition and by price. If he requires the composition possessed by certain cold-blast irons he has to buy them unless he succeeds in obtaining that composition without their use. He has not yet observed any inherent property in any pig iron—admittedly there are many brands that he has had no experience of—when he does observe it he will set to work to produce and publish the proofs of its existence. In the meantime he feels certain that any average American foundry could produce precisely the same results as any average English foundry, each using their own irons and each observing the ultimate composition of the pig iron and scrap iron and controlling that of the cast iron. He feels that there is no difficulty at all about it and he himself would, with the greatest possible confidence, undertake to prove it without any question of pig iron possessing, or not possessing, inherent properties.

Of course the American foundryman, like his British brother, will need to put behind him all prejudice regarding composition. There are two subtle facts which American foundrymen can easily make better use of than has the average British foundryman. Firstly, scrap iron or remelted iron has a different composition to that which it had before it was melted in the cupola; secondly, many of the best cold-blast or semi-cold-blast or white pig irons have different compositions to any other pig irons—these two facts contain many lessons of value to the enquiring foundryman provided he will bury his prejudices.

It is more difficult to get a high strength from grey cast iron containing over, say, 0.6 per cent. of manganese than from an iron containing rather less —other things being equal in each case. It is more difficult to get a high strength from grey iron containing less than, say, 0.09 per cent. of sulphur than from iron containing rather more—other things being equal in each case. To a greater or lesser extent can similar remarks be made concerning carbon, silicon and phosphorus. The length and breadth of the subject are almost infinite and our present knowledge is very minute, but if the foundryman insists upon working upon a range of composition from which it is more than usually difficult to get high tests then he will be unlikely to get them in the ordinary run of events.

Mr. Cook puts before you the highly interesting phenomenon of the phosphide (and sometimes phosphide-cementite) network as discovered by him and the late George Hailstone. Here is not the place to discuss the explanation of the network structure as given by those authors, sufficient to say, firstly, that poor network is usually associated with poor physical tests and vice versa, and, secondly, that the writer has had many instances of both poor and good network arising out of perfectly tangible explanations such as, for instance, a wrong sulphur-manganese balance which balance, at the point of equilibrium, is hardly to be detected by ordinary anaylsis. On the other hand the writer has never seen proofs of poor and good network being caused by inherent properties of the pig iron used nor has he ever seen any paper which satisfactorily, exhaustively and scientifically proved a case of this kind.

In conclusion, therefore, the writer expresses his opinion that the inherent property theory, even if correct, is no explanation as to why the tests of American cast iron are on the low side and he believes that just as high tests could be got from average pig irons as from average British pig irons—this being true in all cases save those where it is absolutely imperative to obtain the particular composition possessed by one or other brand of iron. American or British, and where it cannot be obtained by the use of other brands.

Undoubtedly in our present state knowledge about cast iron we must be prepared and willing to revise our present ideas—but only upon the most reliable and exhaustive evidence.

Extremes of thought have led to extremes in practice, and occasionally American practice gives one the idea that it is a little on the extreme side—low sulphur and high manganese, for instance, are quite reasonable propositions, but, except in extreme cases, there seems to be no advantage to be got from extremely low sulphur or extremely high manganese, or vice versa, while in extreme cases, where such compositions must be worked, one frequently meets with trouble.

This contribution is by no means a criticism of Mr. Cook's paper but is sent solely with the idea of stimulating international discussion and thought upon a subject of great interest. Mr. Cook and the writer have compared notes before now and find remarkably little to argue about when we get down to rock bottom —to get there and to know when you have got there are scientific problems in themselves.

Dr. Moldenke's Opinion on the Subject

THE CRITICISM of American castings contained in Mr. Cook's highly interesting paper is unquestionably merited, but the conclusions are unfortunately based in greatest part on iron made here during the war. Those days are still a nightmare to our foundrymen, who had to use inferior pig irons when they could get pig iron at all; had to melt with coke made from the sweepings of the coal mines, use inefficient men who called themselves molders, and work with organizations that were shot to pieces. One has but to compare the present day sulphur content in our scrap with that before the war to understand what has happened. However, apart from the deplorable metal situation we find ourselves in, and which is bound to become worse as time goes on and the war castings find their way into the scrap pile in increasing quantities, our general practice undoubtedly is to make softer and weaker castings than our British cousins. The reason is not hard to find. Europe makes castings to last. America makes them to machine easy. Europe does not pay machinists American wages. America does not want a machine to outlast its usefulness particularly. We do not point with pride to a lathe or planer of fanciful design, painted in green and striped with gold, possibly of 1868 vintage, which is still too good to scrap. On the other hand, however, our foundry foremen may not have the satisfaction their British brethren enjoy when they make reply to the regular machine shop "holler" about hard iron. So much for the divergencies in practice made necessary by circumstance, and impossible of change in either British or American foundries.

That British furnaces run slower, and hence give better—and as I claim, less oxidized—pig iron than American furnaces, is undoubtedly true, for British irons would otherwise not have had as high a reputation in Germany as they enjoy. Again, our New England foundrymen would not be so desirous of getting scrapped English cotton-spinning machinery for their mixtures. However, we still have furnaces which make fine iron, and produce lines of castings equal to any in the world. Americans are prone to publish their failures freely in the belief that this stimulates discussion leading to overcoming the difficulties, and opening avenues for invention and advancement. I have myself more than once run across parts of machines built in Europe, the broken pieces of which showed just as healthy shrink-holes as our castings. We have all of us still a lot to learn.

When it comes to a discussion of mechanical testing, I must confess that I am somewhat puzzled at the summary of British practice, as presented by Mr. Cook. With us here, the Keep method is considered so antiquated that it may only be found sporadically in stove shops as yet. With all due respect to the attainments of Mr. Keep, whom many of us remember and whose friendship we valued highly; none the less his usefulness as a guide ended when he refused to adjust himself to the, for him, uncomfortable facts brought out by foundry metallurgy. Possibly it is this study of cast iron in the light of the engineer, rather than as engineer and metallurgist, that makes me wish Mr. Cook had explained why Britain still uses square and flat bars, cast horizontally rather than round ones cast vertically. You have only to do as I have done—slice the flat bar into three, longitudinally, and test each unit, to see how different the metal at the corners and edges is from that in the middle. We still have left one branch of the foundry industry using a flat bar, and this industry is now considering the advisability of getting up to date.

Looking over some of the strengths quoted by Mr. Cook, with analyses given, we are rather prone to explain the results by the remarkablly low silicon-content combined with pretty low total carbon conditions. We get the same strengths here under the same conditions. That you do this regularly, and we but sporadically, and only when wanted, entitles you to our best congratulations. We wish we could do this all the time too and have peace with our machine shops.

As to the tensile test, it seems that the engineer—used to working with the elastic limit of materials—needs must have its values in tensile strength figures to understand them, even if he has to convert these figures later to transverse strengths. The foundryman, on the other hand, knows that cast iron is rarely used under a direct pull, but has to stand bending application. Hence he naturally gravitates to the transverse test. Yet this is really a tensile test of the outer fibres of his bar. Mr. Cook has mentioned my objections to the tensile test as our machines are not reliable. This has changed very much for the better, as our present day machines are arranged for a cast iron test piece with proper threaded ends as called for by the now universally used "Arbitration Bar" of the American Society for Testing Materials, and the American Foundrymen's Association, jointly. Formerly a bar of cast iron was simply inserted in the "V" grips of the machine, and the results almost always came out low.

The question of a proper "International Test Bar" is now being studied here carefully, and it is to be hoped that early conferences may take place looking toward interchange of facts and thoughts between Britain and ourselves, this to extend to the other European nations as rapidly as they may be willing to co-operate.

Mr. Cook is unquestionably right in holding that we have over-rated the bad effects of sulphur. Possibly this is so for just the reason of our weak castings as against their strong ones. At any rate, we here fear the effect of shock, and this is notoriously connected up with the sulphur content. We have now become alive to the importance of oxidized metal as being far more dangerous than high sulphur, and knowing more of rational cupola practice now than we did some years ago, our sulphur has gone higher without serious consequences because our better melting practice has allowed this. As Mr. Cook has not touched upon this phase of the foundry problem, it is not easy to follow his studies on the physical structures of cast iron. In addition to the anaylsis—oxygen being unfortunately not yet part of a regular analysis—a diagnosis of the iron for pig and scrap proportion, the melting history, approximate pouring temperature, and other things are necessary to understand the product made.

We are very much indebted to Mr. Cook for giving us the present status of British practice with regard to cast iron, known only to those of us who have been over there recently. His remark that even over there the furnaces are beginning to force production, and thereby lowering the quality of their product, leads me to think that possibly some day the foundrymen will force the production of better iron by paying for it, and eventually the sheep will be effectually separated from the goats in furnacedom, so far as the foundry is concerned.

Probably such information will explain to British foundrymen some of the reasons for the production of some castings of poor quality during that critical period in world history when it seemed that the map of Europe was to be redesigned to suit the central powers.

What Steven B. Phelps of Pittsburgh Thinks

THE PAPER on American versus British grey cast iron by Mr. F. J. Cook is very interesting. The paper contains many statements, however, that American foundrymen and engineers know to be incorrect if it is inferred that the inferior castings cited represent standard American practice.

The statement is made that large quantities of machine tools sent over to England during the war had very poor wearing qualities and that it was said that "the cast iron was so soft as to be easily cut by a pocket knife." Those pocket knives must have been made from that recent American invention "stellite."

Certainly castings of the grade mentioned were not made in foundries which generally supply the machine tool trade, and they must have been made by foundries unfamiliar wtih the requirements of machine tool parts.

The following statement is also made: "Recently, some improvement has been noticed, attributed partly to wider bearing surfaces, and the application of chills on wearing parts, combined with the use of semi-steel."

The writer was the melter in a foundry in a machine tool center several years before the war, and melted 50 to 60 tons of iron per day for the machine tool trade. Several grades of iron were made, as well as semi-steel for parts subject to wear. In addition, chills were used very liberally on surfaces subject to excessive wear. The grain of the iron and its hardness received special attention and frequent trips to the machine shop were customary as one method of keeping in close touch with the quality of the products. The practice mentioned was not an innovation at that period, but was general practice. The writer has seen the same care taken in other foundries making machine tool castings.

As to castings breaking, that is news also, as I never knew of that being mentioned as a foundry problem.

Quite a number of new foundries and machine shops were started during the war, and all kinds of foundries were asked to make castings regardless of their knowledge of the required products. That no doubt resulted in products in many lines being made below the usual standards.

The emergencies of the war not only brought many novices into industrial business, but it interfered seriously with the quality of the output in industries of long standing. Coke, sand and metals were extremely difficult to obtain and the grade was often unfitted for the products that had to be made regardless of standards.

The writer was superintendent of a foundry during the war which was asked to make castings for a machine tool company. The mixtures used in that foundry were not suited for machine tool requirements. It naturally occurred to me then that machine tool companies would have difficulties, if they were obliged to buy castings of any foundries that could make deliveries regardless of their lack of the special knowledge needed to produce strong machine tool castings with good wearing qualities. For long periods I had to forget about mixes for our castings, and mixed mostly by fracture and observation of the product as it was useless to get an analysis for we could not get the proper pig iron. The analysis of one carload of coke showed 20 per cent. ash and we had to use it or shut down. If we had shut down we would have lost our force for the labor turn over was very high anyway, so we used the coke for several days and specialized on the "standing order" for scrap.

NATIONAL SAFETY COUNCIL MEET

(Continued from page 23)

men. This is being well taken care of as the following will show:

Metals Section

Chairman, J. R. Mulligan,
Safety Inspector, Bethlehem Steel Co., Bethlehem, Pennsylvania.
Vice-chairman, J. A. Northwood,
Safety Engineer, Cambria Steel Co., Johnstown, Pennsylvania.
Secretary, Walter Hart,
Safety Inspector, Jones & Laughlin Co., Pittsburgh, Pennsylvania.

First Session

Tuesday Morning, August 29, 9.30 o'clock.

Program

1. Report of chairman.
2. Report of secretary.
3. Reports of committees.
4. Appointment of nominating committee.
5. Addresses:

(1) Outstanding Features of the Safety Movement in Iron and Steel, 1910-1919, Dr. L. W. Chaney, U. S. Bureau of Labor Statistics, Washington, D. C.

(2) Safety in Electric Furnace Operation, E. T. Moore, Electrical Engineer, Halcomb Steel Company, Syracuse, N. Y.

Information can be received from G. E. Wallis, Director of Publicity, National Safety Council, 168 North Michigan Avenue, Chicago.

Second Session

Wednesday Morning, August 30, 9.30 o'clock.

Program

1. Report of Nominating Committee.
2. Addresses:

(1) The Safe Handling of Gas at the Blast Furnace.

(2) Safety in Crane Repairing.

Joint meeting of automotive, drop forge, and metals sections, Friday 9.00 a.m.

Link Belt Company, 910 S. Michigan Avenue, Chicago, with Canadian plant and office at 265 Wellington St. West, Toronto, are distributing a neat catalogue with 32 pages entitled "Link Belt Conveying Machinery for Foundries," which is just off the press. This company has been building conveying machinery for foundries since 1889 and some of this earlier equipment is still in active use. Out of these years of experience they have built up a fund of knowledge which has been incorporated in this book. They invite foundry superintendents or anyone interested in the subject to write for a copy. It is well illustrated and the entire contents are for the benefit of the foundry business.

Wonderful Drawing Power of A Magnetic Pulley

Actual Test of Drawing Strength of Bar Thrust Against Magnetic Pulley Holding Up Six Men, While the Seventh Was Suspended From the Nails in His Shoes

MAGNETISM is a force, of which we know even less than we do of electricity, of which, Thomas Edison says: "We know nothing." We know how to produce electricity, so likewise we know how to produce magnetism. That the two have certain characterist'cs which are derived from the same source we have reason to believe The natural loadstone or magnetic iron ore is, in all probability charged with electricity, yet while electricity will travel over either copper or iron wire it will magnetise iron but not the copper. While copper has many advantages over iron as a conductor of electricity it has no attraction for a magnet. These are just a few of the peculiarities of these wonderful forces, which no scientist has been able to descr:be in any better way than to refer to them as phenomena. However, scientists have learned how to capture these forces and utilize them for the service of man. They have learned how to charge ferrous bodies with electromagnetism so that it w:ll remain magnetised and they have also learned how to use similar bodies as mediums through which to convey the electro magnetic current without having permanent effect on the medium. Thus a pulley may be connected to the current and it will attract anything of a ferrous nature while having no attraction for anything non-ferous. As soon as the current is turned off, it has no attraction for either. By this means it is possible to utilize this force in separating the two substances. Were it not possible to make this pulley of a material which would convey magnetism while not becoming magnetized itself this could not be so readily done. Like electricity, magnet'sm is very powerful, but unlike electricity it is harmless. It has no attraction for human flesh and blood and can be handled in connection with magnetizing machinery without fear be it ever so powerful.

Strength of Magnet

If a machine of this type using a magnetic pulley is contemplated the question might be asked:—

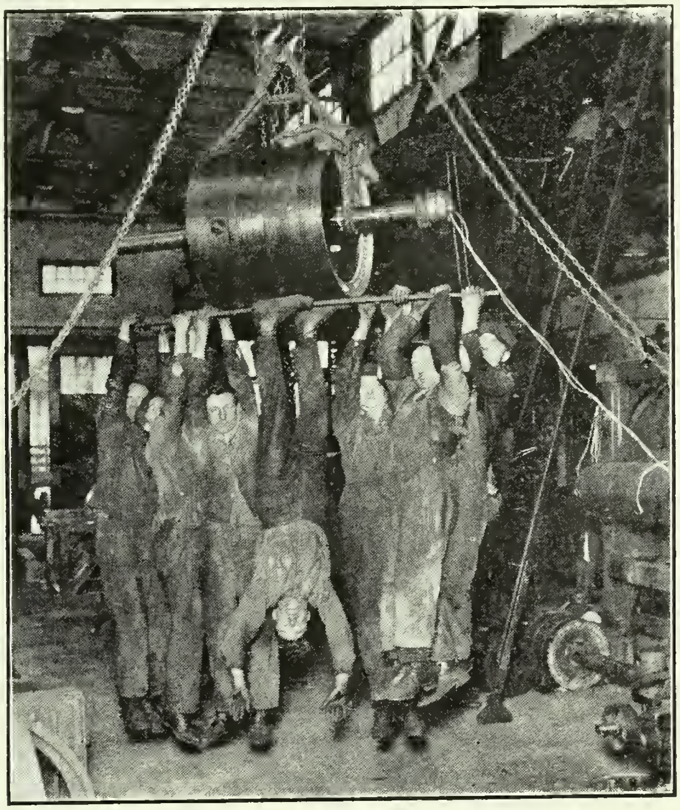
What is the strength of a magnetic pulley?

Here is a forceful answer.

The Dings Magnetic Separator Company, Milwaukee, Wisconsin, photographed seven men suspended from a Dings Pulley to vividly illustrate its remarkable magnetic strength.

The only support of the man hanging head downward is the attraction of the pulley for the iron in his shoes. The area of the iron bar in contact with the pulley is very small, yet the total weight of the six men suspended is about 1000 pounds.

The Dings Company states that a pulley must possess the great magnetic power that this test demonstrates in order to be effective at all times in removing iron from conveyed material. The necessity for this is explained by the fact that in attracting fine particles of tramp iron through a heavy load of conveyed material a magnetic force sufficient to directly support an enormous load is required.



Nothing to hold up this half ton of humanity but the attraction of the magnetic pulley for the crow bar and shoe pegs to which they are hanging.

Magnetic separators are for two purposes, one is to remove undesirable iron or steel from non-ferrous turnings while the other is for saving good iron from refuse about the foundry. In either case the iron or steel is attracted to the magnet.

It is easy to understand that iron will adhere to a magnet but not so easy to realize that it will do a lot more than adhere. It will be drawn for a considerable distance out of a conglomerate mass of other material.

A magnetic separator is a machine which does a number of mechanical movements such as delivering the different kinds of material to their respective places, but the magnet is the real soul of the machine and upon its ability to perform its function properly depends the success of the magnetic separator.

When it is considered that the surface of the pulley is curved and that only a narrow streak along the center of the bar shown in the illustration is in actual contact with the pulley it will be realized how great is its drawing power. The man hanging by his shoe pegs would appear to be the most remarkable feature, but small as is the surface of the ends of a few shoe pegs, he probably has a much greater surface actually pulling on him than would be the average for each man hanging on to the bar.

Sure to do the Job

Obviously a magnetic separator would thoroughly separate iron from any other material and would be a great saver of good iron which too often goes to waste as well as making inferior brass and bronze turnings equal to new material.

Every brass foundry of note has a magnetic separator but there is a surprising number of iron foundrymen who do not seem to realize what they could save by its use and how soon it would pay for itself.

A New French Electric Furnace for Steel Foundry

Constructed With an Idea of Insuring Good Purification by Direct Passage and Uniform Distribution of the Current Through the Metal and Slag.

By R. SYLVANY.

THE GREATLY increased application of electrometallurgy has directed fresh attention to the different types of electric furnaces capable of being successfully employed for melting and refining metals. Many types of furnaces have already been adopted in industrial practice and have been widely installed.

The furnace described in this paper, the idea of which is due to T. Levoz, a French metallurgist, presents certain interesting features, and illustrates one of the latest French developments in this field. The use made of it during the war for the production of high speed steel demonstrated the principles on which it is constructed and which we shall briefly describe.

The refining of a steel bath is effected by the action of the slag, of a fixed composition, on the molten metal. This action is made up of several reactions which require for their realization certain conditions already laid down by Prof. Campbell in the course of a meeting of the British Iron and Steel Institute, when the first practical trials of electric furnaces were being made.

The slag must be brought to a high temperature, as this temperature and the resulting fluidity combine in facilitating the refining reactions. The rapidity of these reactions, indeed, increases with the temperature, the increase being much more than proportional.

The great fluidity maintained in a basic slag and the formation of calcium carbide by the action of the arc upon the limestone slag are two conditions which favor desulphurization.

The thorough rabbling of the bath is indispensible, as it is necessary that every part of it in succession shall be brought in contact with the slag so that it may free the metal of its impurities. This rabbling must be secured by a suitable distribution of the current.

For this reason Prof. Campbell laid stress upon the following important points, the realization of which appeared to him essential:

The furnace should be closed as much as possible and should be of the simplest possible construction; the furnace should be entirely separated from the electrical fittings of the generators and transformers, which should be maintained at their highest capacity in order to increase the power of the installation; the wear of the refractory materials of the linings should be saved by applying the heat at the center of the bath, and those of the roof by protecting them from the direct radiation of the arc by the electrodes themselves; the slag should be given as large an area as possible so as to increase the refining surface; and the temperature of the slag should be maintained above that of the steel, so as to secure fluidity and facilitate the high basicity required by an intensive refining process.

Prof. Campbell also divided the use of a homogeneous and solid hearth, and with this view, recommended that electrodes should not be allowed to pass through it. On the other hand, Dr. W. Borchers, who was one of the pioneers of electrometallurgy, was speaking of the satisfactory results obtained by this latter type of furnace. The principle of this, the Girod furnace, was based on a combination of the resistance arc furnace, the slag covering it forming an electrolytic conductor, the metal constituting the resistance and the current being distributed by one or several carbon electrodes traversing the roof and by multiple contacts passing through the bottom. There was no question of the solidity of this furnace. The advantages arising from a uniform distribution of the current, effected by the arrangement of the contacts passing through the bottom, constituted one of its essential characteristics, namely, that of insuring the efficacy of the furnace's refining action.

The section and length of these contacts were such that no one of them could carry more than a certain fraction of the total current without becoming overheated and, consequently, without its resistance being excessively increased. The regulation of the temperature and resistance of each contact was effected by cooling the hollow extremities by a water circulation system. Certain inconveniences were thus remedied, and as a result of the uniform arrangement of the contacts round the prolonged aves of the carbon electrodes the advantage of a uniform rabbling of the bath was obtained. Prof. Campbell's one objection thus disappeared; moreover, the results already obtained at that time demonstrated the furnace's merits.

Life of Lining

When regularly working, the lining, which was chiefly composed of burned dolomite, withstood at least 80 heats. The bottom of the furnace stood 120 to 160 heats without repair and had then lost 100 millimeters in thickness. With charges of molten metal the lining could stand 200 operations, and the roof about 20 to 35. The wear of the other parts of the furnace was comparatively slight and the consumption of carbon electrodes was from 12 to 15 kilograms per ton of steel.

The principles adopted in the Girod-type furnace, which was also to be adopted in the Keller-type furnace with a better distribution of current, thus marked an advance in the construction of electric furnaces.

In the Keller-type furnace the distribution of the current in the bath, instead of being merely carried round a certain number of contacts, was effected over the whole depth of the bath by means of a bundle of iron bars surrounded by refractory clay which formed the furnace bottom. The current was introduced by a large carbon electrode rectangular in section.

As in the Girod-type furnace, the intensity of current necessarily was high, as it had to reach 3,000 amperes; but this high intensity had fewer disadvantages as the current was better distributed and the electric resistance in the large single electrodes and in the conducting hearth was not as great. The difficulty of water cooling and of overheating of the carbon electrodes was avoided.

The principles laid down by Prof. Campbell therefore were observed in this furnace, notwithstanding the fact that the conductors passed through the hearth.

On the other hand, it might be objected that they were not followed in the first furnaces of the Heroult type, in which the better basic action was counteracted by the imperfect closing of the furnace, which was opened by three lateral doors and had two electrodes passing through it from the roof. Nevertheless the effectiveness of the furnace was not as great as it might have been, although the rectangular surface of the bath was extended, because of the action of the arc being concentrated only in the vicinity of the electrodes. The intensity of the current alone was greatly reduced. The rectangular section, therefore, was unsuitable and at Remscheid it was reduced only to the zone of action of the arcs. The circular form introduced by Nathusius seems to be preferred, and it was this form of section which Heroult adopted for the 15-ton furnace which he built in the United States.

A New Type of Furnace

All these considerations led the inventor previously mentioned to produce a special type of electrical furnace, in which the principles already indicated were further developed and the various defects were minimized.

He sought on the one hand, to secure rapidity of fusion and on the other to insure good purification by making the current pass as directly as possible—but at the same time with uniformity of distribution—through the metallic mass and the slag, the furnace being simple in construction strong and well closed, without excessive current necessary.

For this purpose he constructed a close crucible with only one opening for charging the material and the additions and for pouring the finished metal. He also placed the large carbon electrode in a sheath to obviate air currents in the space left free between the electrode and the roof. Thus he facilitated a better basic action.

Moreover, certain trials made for the first time at the electric power station of the commune of Jambes in Belgium enabled him to discover the possibility of placing electrodes in the lateral linings of the crucible without their being affected by wear at that level.

In fact, as the lateral linings of the furnace presented a larger surface than that of the hearth (bottom) the number of iron conductor bars embedded in the linings can be increased so that their section can be lessened.

Thus a strong magnesite bottom can be composed which resists the action of overheated metal much better than an armored hearth.

Wires of 6 to 10 millimeters were found sufficient to obtain currents of 1200 to 1500 amperes at 85 volts capable of developing the temperatures necessary for the purification of the entire mass notwithstanding the depth of the bath.

The electric resistance of the conductor electrodes thus constituted is almost negligible, for, as has already been pointed out, the surface of the linings permits bringing into play a considerable number of wires equivalent to such a large conductance section that, without taking account of the conductivity of the bottom, the loss is already practically nil.

The use of small section metal conductors, tends to produce a more uniform circulation of the electric current than the use of large section conductors, and the large surface of the positive carbon electrode is well utilized owing to the excessive splitting up of the current at the surface of the bath.

The slag is highly and uniformly heated throughout its surface, and its temperature may be raised to the point required to secure good fluidity and intense chemical action.

Two Rows of Electrodes

To facilitate the process of refining still further the inventor was led to adopt a special device which consists in introducing two rows of superimposed lateral electrodes, the lower ones being termed fusion electrodes and the upper ones refining electrodes.

The fusion electrodes, which vary in number with the capacity of the furnace, are formed by a bundle of pure iron wires imbedded at the base in a mixture of magnesia and tar and united at the top so as to give a good contact with the metal contained in the crosswise channels arranged in the furnace hearth.

These electrodes are joined in series by a copper bar, which is itself connected by cables to the negative pole of the current transformer. The refining electrodes, which are placed on a level above that of the others, facing the slag, are also variable in number according to the capacity of the furnace.

A special device enables the current to be taken from the fusion electrodes and afterwards from the refining electrodes, or alternatively from both rows of electrodes at once.

The number of wires forming the electrodes, as also the section of these wires, varies with the capacity of the furnace. The wires of the fusion electrodes have always a larger section than those of the refining electrodes.

In every case the current enters by a large vertical carbon electrode passing through the furnace roof, its horizontal section being half that of the furnace crucible.

When direct current is employed this large positive electrode is hollowed out and forms a heat reflector; moreover, the oxygen of the bath is liberated and is carried to the positive pole instead of remaining in the bath and oxidizing it.

The furnace proper consists of a steel plate body with a nonconducting refractory lining and fitted with a cover. Hollow trunnions, through which the conductor cables pass, enable the whole apparatus to be tilted.

In this furnace the current always passes through a layer of relatively thin metal, which enables currents of much lower intensity to be used. An intensity of 1500 amperes is not exceeded, never-the less the temperatures obtained are diffused throughout the entire mass of the slag and metal.

As was mentioned at the beginning of this paper, this furnace was employed during the war in the production of high-speed steel. It was installed at the Jarville works of the Eclairage Electrique Co., near Nancy, now amalgamated with the Thompson-Houston Co. The results obtained appear to indicate that with continuous working and by treating 1000 kilograms per heat with an amperage of 3000 at 80 volts it would be possible with one furnace to obtain an output of eight tons per day by deoxidizing the metal obtained from a converter.

LOTS TO LEARN YET

The rustless and acid proof alloys which have been featured in the last few issues of this paper will undoubtedly be developed into much greater usefulness than at the present. None of the metals which are used in the alloys are new to the metallurgist but their adaptability to ordinary engineering feats is just beginning to be appreciated.

Metals, which for many years had been of interest only to the scientist and to the laboratory investigator, are now used with signal success in the making of articles of high value in the industrial arts. Chromium is one such metal, and, alloyed with nickel, it forms the basis of many alloys used where high temperature conditions are encountered. Carbonizing boxes, annealing pots, lead pots and similar articles are subjected to the action of external heat, and it is desirable that the materials from which they are made should possess a number of characteristics, such as the power to resist the action of either oxidizing or reducing flames; resistance to the action of metals and salts and toughness under high temperature conditions, even as great as 2,500 degrees F. It is also desirable that the material should be soft enough for machining.

The physical qualities of the alloy closely resemble those of steel even when heated. The metal machines similar to a medium high carbon cast steel, yet, when machined, does not oxidize or rust, but maintains for a considerable time its grey appearance. Unlike steel, too, it does not become porous when heated, and when used for carbonizing boxes this property tends to the conservation of the carbonizing compound. The life of the boxes depends, of course, upon their size and thickness, as well as the temperature to which they are subjected. Life runs of about 3,500 hours are common.

The life of nickel content alloys when used for containers of molten metals or salts to some extent depends upon the percentage of nickel. In this alloy the nickel content is low and a scale is formed when heated in the air. By producing the scale artificially in the interior of the pots it is possible to prolong the life very materially.

Manufacture of Nichroloy Products

Naturally enough, when the product has to withstand high temperatures in the performance of its duties, its manufacture involves the use of higher temperatures to secure fusion and in the electric furnace is found the most suitable means of melting.

In the making of nichroloy, the nickel is charged into the furnace in shot form and the chromium as ferrochrome. No slags are needed for refining as in steel making, the only additional agents needed being ferrosilicon and ferromanganese. These ferro-alloys seem to eliminate an oxide formed in the metal.

Monel Metal

In the making of alloys which resist corrosion, there is a broad field for a metal which will withstand acids, high temperatures and the erosive action of hot gases and super-heated steam. Monel metal meets these severe requirements.

Monel metal is not a synthetic alloy, but is a natural combination of nickel and copper, which is refined without changing the relation of the important elements, i. e., nickel and copper. These two metals bear the same relation to each other when the alloy is refined and fabricated as in the ore taken from the mines. The alloy contains approximately 67 per cent. nickel, 28 per cent. copper and 5 per cent. other metals.

In making castings, the natural alloy, either in shot or ingot form, is charged into the furnace and melted down.

A European View of the Malleable Iron Problem

After Reviewing the Position Taken by European Producers of Malleable at the Recent Foundrymen's Congress at Liege, the Author Speaks in Commendation of American Success

By T. LEVOZ.

The position of the malleable castings industry on the continent of Europe was considered at length at the joint French and Belgian foundry congress held at Liege at the end of last September. The following passages embody the principal opinions expressed:

"The first aim should be to interest all our French, English and Belgian confreres in the institution of systematic experiments, which should all be carried out in a uniform manner so that they may be compared and the results intercommunicated.

"Permanent intercourse also should be maintained with our American confrees and steps should be taken to insure the regular exchange of communications between the various associations.

"The second aim should be to interest the leading French, English and Belgian scientists in the investigation of the laws governing the manufacture of malleable iron, chiefly, in regard to the effect of the silicon and that of the sulphur, on the condition of the carbon both at the two stages and on graphitization of the carbon.

"In this way, we shall attain the position long ago reached by our American confreres; that is to say we shall be able to compete successfully with cast steel both as regards quality and price, thus preventing the disappearance of an industry which was formerly flourishing but which is declining because European foundrymen work neither scientifically nor economically and are lacking in co-operation.

"Before the war the average cost price of an American manufacturer of malleable iron turning out agricultural machinery castings was 25 centimes per kilogram, (about 2.4 cents per pound). Making all due allowances, there is no reason why we should not attain the same results."

Since then the Belgian and French technical foundry associations have met and decided to form a special commission for the purpose of carrying into effect the wishes expressed at Liege.

Special attention has been excited by the exceptional results obtained by American foundrymen as regards the quality of the metal which, it appears, ordinarily shows the following mechanical characteristics:

Resistance: 30 to 50 kilograms per square millimeter;

Elongation: 5 to 25 per cent. measured over 50 millimeters; as compared with 30 to 40 kilograms and 2 to 4 per cent. in European practice. Here there is a wide gap, and in order to bridge it it is not enough merely to agree to establish uniform methods of experiment. What is required is an agreement to establish a single mode or method of production capable of supplying a metal suitable for the manufacture of good test pieces corresponding in structure to castings usually required in malleable iron.

What is a Suitable Metal?

I am considering here only the production of the metal, which is the starting point of all manufactured castings for when the metal is suitable three fourths of the work of successful casting has been done. What, then, is to be understood by "suitable" metal? In general foundry practice (ordinary cast iron, malleable cast iron or cast steel) suitable metal is understood to be that which when cast flows over the sand on contact with it without attacking the organic matter. It is, of course, understood that the metal must combine the mechanical conditions and characteristics required. In order that the metal shall flow over the sand its iron oxides must previously be reduced, and if they are not reduced completely it is preferable that they should be in the ferric rather than the ferrous state.

Many foundrymen are imbued with the idea that a metal cast too hot prevents the scrapings of the sand on contact, but this is a mistake.

Of course, apart from the question of pipes and shrinkages a perfectly deoxidized metal may be cast at maximum temperatures without attacking the organic matter of the sands employed in foundries—for ordinary cast iron, malleable iron or cast steel. The error is chiefly noticeable among founders of cast steel, who often regard a dazzling metal as being too hot, even when it is greatly superoxidized, sometimes to the point of solidifying almost instantaneously when it is decanted into the ladle.

The purpose of these remarks is merely to point out to founders of malleable iron that their interest is not merely to study the part played by the carbon, manganese, sulphur and phosphorus, and that they have invariably neglected the part played by the principal factor—the iron oxide—which is the source of all their troubles and disappointments.

It is, in fact, the greater or less degree of oxidation of the iron that governs the temperature of the bath and, consequently, its composition.

Generally, whether it is a question of ordinary cast iron, of malleable iron or of cast steel, in which the oxidation of the iron plays the most important part, it is necessary to have the initial metal at the maximum temperature so as to facilitate all the reactions necessarily arising from the presence, in larger or smaller quantities, of the ferrous or feric oxides.

Now the former absorbs heat calories in order to be reduced in presence of the carbon while the latter releases them. This is why it was stated earlier in the paper that it was preferable for the unreduced oxides in the metal to be in the ferric state.

It is easy to determine the presence of either of these oxides in liquid metal containing only iron and carbon, with a minimum of silicon and manganese.

Metal containing ferrous oxides boils violently in presence of carbon and liberates graphitic carbon at the moment of solidification because all boiling causes cooling.

Examine the worn rails on the P. L. M. tracks; they are full of blisters flattened out at the rolling mills. These blisters contain graphite and unreduced ferrous oxides. This is a striking example of cooling produced by boiling, ferrous oxides and carbon.

Selection of the Furnace

To obviate this capital defect in the production of iron for malleables—a defect essentially of a practical nature—it is absolutely necessary that the first stage metal should be produced in apparatus providing maximum temperatures without the formation of ferrous oxides.

Foundrymen have available the crucible which was the first system of manufacture employed. It requires mixtures of good quality, and as the materials composing these are not exempt from rust, ferrous oxides are developed during fusion. To remedy the bad effect so produced the temperature of the furnace must be increased. This causes an excessive consumption of coke or coal, the result of which is a prohibitive cost of production.

The cupola furnace, which is mostly used, is the producer par excellence of ferrous oxides. It is a barbarous principle of fusion, especially for the production of iron for malleable castings. To be able to cast the metal at all suitably, the maximum temperatures must be obtained; the consumption of coke must be increased, as must also the silicon content. Hence the common practice of forcing the silicon addition in order to be able to make exceedingly thin castings.

The reverberatory furnace undoubtedly is the apparatus which least occasions the formation of ferrous oxides. However, it also is at the mercy of rusty materials and of other oxidizing tendencies. If the Americans employ it with success in producing malleable iron of great elongation and strength, this is because they have succeeded by practical methods in obviating the formation of ferrous oxides by effecting the fusion in a carbon oxide atmosphere. Unfortunately the employment of reverberating furnaces is practicable only for mass production, and the consumption of malleable castings has developed less in Europe than in America.

If European foundrymen had at their disposal a cupola obviating oxidation of the iron it is evident that such an apparatus would be the ideal method of producing malleable iron, subject to the condition, however, that it should effect fusion at the highest possible temperature.

Four years ago, in the Fondrie Moderne, the writer drew attention in this connection to a small cupola with two tuyeres placed in different heights, with which he had obtained good results in a malleable iron foundry in Belgium.

Fusion of gases is less to be recommended, because it is almost indispensable to produce oxidizing flames in order to secure the high temperatures required. In this connection it would be preferable to effect fusion by the pulverized (slack) coal system, provided regenerators capable of heating the air of combustion to over 600 degrees Cent. are employed.

This applies also to the use of heavy oils, and in this case it is also necessary and indispensable to have a furnace specially arranged for an adequate distribution of the heat without oxidizing the iron.

Electric Furnace Experiments

The converter and the electric furnace remain. The latter, when employed as a fusion apparatus, is also at the mercy of pig iron, scrap or other rusty waste; the operation must be carried to the point of complete deoxidation, and even at this point it is difficult to obtain uniform carburization.

Recently the author made an experiment to see to what extent a metal fused electrically, obtained from highly oxidized scrap, and containing also 25 to 30 per cent. of turnings agglomerated by the oxidation of the atmosphere, could be carburized and poured. Nothwithstanding the fact that the slag was well composed and the temperature raised to the extreme limit, uniform carburization could not be obtained, and the metal, which appeared hot while in the furnace, solidified on being poured into the ladle because it still contained ferrous oxides which in spite of everything had not been reduced.

The only method of producing malleable iron electrically of uniform quality is by starting with scrap or a mixture of scrap and pig in a coke or coal fired furnace. The metal thus obtained is poured into a closed electric furnace where it is finished, but for this purpose a powerful and cheap supply of electricity must be available. One foundry in the Hautes-Pyrenees, however, to which the writer is adviser, works on this system and obtains excellent results. It even provides foundrymen with pig iron produced by this method, which when remelted in cupola, crucibles or other furnaces, gives better results than blast furnace pig, because it contains a minimum of graphitic carbon and a minimum of sulphur.

The German Method

In my opinion the only method of competing successfully with cast steel in Europe is to produce malleable iron on the came system of cast steel. The Germans, who have long specialized in the manufacture of cast steel and malleable iron, clearly recognized this, and since 1905 they have been making malleable by melting hematite pig in the cupola, afterward transferring it to the bessemer converter in a liquid state in order to desiliconize it and pour into the moulds a metal which is merely carburized.

Three Germans introduced this method of manufacture into France with some success.This was at Colombier Fontaine Doubs, abut 1911. They did not succeed, however, in competing against cast steel which they were obliged to produce also to supply the requirements of their clients. This was because this process was far from perfect.

As a result of the sequestration of this establishment shortly after the declaration of war (January, 1915) the writer leased the factory and was thus in a position to acquaint himself with the quality of the metal produced.

It was far from suitable for the uniform production of good malleable iron. A sample was taken from the numerous gates found in the works and analyzed, its composition being as follows:

	Per Cent.
Combined Carbon	2.80
Graphite Carbon	0.50
Manganese	0.30
Silicon	0.80
Sulphur	0.06
Phosphorus	0.09

The ordinary bottom-blown bessemer converter is not at all suitable for this kind of work, as it produces ferrous oxides while it is desiliconizing the metal. The result is that the white pig bath is obtained too cold, which causes the formation of graphite carbon at the moment of solidification.

Without even trying this process, the writer decided not to employ it. In this he was well inspired for he found that the molders who had formerly worked with the Germans ran like hares to fill the molds placed at a maximum distance of 50 meters from the converters, although the metal was much too hot and fluid.

When asked the reason for this, they replied that when the Germans were there they were always made to hurry to cast the malleable iron, "otherwise they would not have produced a good casting."

If from time to time a good casting was produced this was owing to the metal bath in the cupola having been overheated.

In 1915 the author started working scrap metal in the cupola, transferring it by means of a ladle suspended from the crane to a side-blown converter with D-shaped section, which had been installed by the Germans for the manufacture of cast steel. According to the men who had worked with the Germans, the metal we were producing was much better and more fluid. It was no longer necessary for them to scurry like hares to fill the molds. They found also that we turned out few spoiled castings, whereas the Germans used to have 20 to 30 per cent.

The composition of the metal delivered from the converter was as follows:

	Per Cent.
Combined Carbon	2.340
Graphitic Carbon	0.200
Manganese	0.440
Silicon	0.750
Sulphur	0.101
Phosphorus	0.082

The higher sulphur content was due to the quality of the coke used during the war. The Germans used coke which contained less than 10 per cent. of ash and little or no sulphur. However, when the metal in the converter was too cold, or when, for any reason, the desiliconization was accompanied by the formation of ferrous oxides, violent boiling took place as the metal flowed from the ladles, and the slag, which was extremely fluid, was carried into the molds along with the metal. It was then necessary to put a small addition of aluminum in the ladles to calm the bath and obviate blistering as much as possible.

Fractures of the reheated castings then showed a black structure similar to American castings. The castings were, however, exceedingly malleable, and they bent even better than those having a granular structure.

The mechanical tests of this metal gave the following results: Resistance, 35 kilograms per square meter; elongation, 5 per cent. measured over 100 millimeters.

Its chemical composition was:

	Per Cent.
Combined Carbon	0.100
Graphite Carbon	1.200
Manganese	0.330
Sulphur	0.101
Phosphorus	0.082
Silicon	0.987

The same metal without aluminum addition had a granular structure, from which it may be deduced that the presence of the aluminum for the purpose of reducing the ferrous oxides immediately before solidification favoured the formation of hardening carbon or secondary graphite.

At this time it seemed that in order to obtain a more uniform metal, the metal from the converter ought to be passed into a furnace heated to 1500 degrees Cent., either by the gases, or by heavy oils or electricity, and that it ought to have a small admixture of metal taken from the cupola.

In 1915 the author registered a patent in France for this process, and it appears that about the same time W. G. Kranz took out a similar patent in America for a "triplex process for making electric furnace malleable castings." The writer subsequently recognized that it was undesirable to reintroduce metal produced by the cupola, which favors the formation of graphite at the moment of solidification. The converter was installed with cylindrical crucible and tuyeres arranged tangentially to a circle of fixed diameter. A hotter and more liquid metal was obtained, because ferric oxides were formed at the surface of the metal bath and there stimulated the desiliconization and, to a certain extent, the decarburization, while maintaining the bath at the necessary temperature for casting without any aluminum addition.

When the operation is carried out normally in this converter the reddish vapors surrounding the flame do not appear until after desiliconization and at the very beginning of decarburization, increasing in proportion as the latter advances. The vapor ought not to cease on the first break through of the flame; it ought to continue until the second break and issue abundantly at the end of the blow.

If the reddish vapor is plentiful at the outset of the operation and diminishes or ceases on the first break through of the flame, ending with a rather bluish vapor, this indicates that the operation has not been effected normally.

In the first case, the adjustment for obtaining the malleable iron has been well determined, while in the second case it has been faulty, the result being variations in the quality of the metal. It then occurred to the writer to pass this metal, still taken in a very hot and fluid state, into a furnace heated to 1550 degrees Cent., either by the gases, heavy oils or pulverized coal, but preferably by electricity, merely for the purpose of deoxidizing, desulphurizing and regularizing the carbon, silicon and manganese contents.

Under the following conditions in the first case there is formation of ferric oxides which obviate the ebullitions which are so detrimental to obtaining suitable metal, and under these conditions the operation of adjustment in the furnace is easily effected.

In the second case ferrous oxides are formed, causing ebullitions and rendering the final operation of the furnace more complicated. It is necessary to overheat the metal bath in order to bring about a really effective reduction.

It was after coming to these conclusions that the author finally took out a French patent on this method of manufacture. An English patent also has been granted.

In order to work this triplex process accurately and obtain the metal desired it is essential that the following apparatus should be employed:

1.—A cupola with combustion zone distinctly separated from the zone of fusion in which only reducing gases circulate.

2.—A side-blown converter which evacuates the slag as fast as it is formed, insuring the formation of ferric oxides which secures the fluidity of the metal for the purpose of preventing the formation of graphitic carbon on solidification.

3.—An electric furnace which insures the proper distribution of heat with a minimum expenditure of electric power; or a heavy oil furnace, if electricity is not available.

The average composition of the metal obtained is as follows:

	Per Cent.
Combined Carbon	2.30
Graphitic Carbon	traces
Manganese	0.30
Silicon	0.40
Sulphur	0.03
Phosphorus	0.05

This metal, being obtained very hot and freed from oxides, flows over the sand and produces castings which look clean and are without the defects usually found in ordinary malleable castings.

It is noteworthy that castings of the most complicated form may be left to cool in the molds with little risk of dents, cracks, flaws, fractures or other defects. The constant use of a reheating furnace, always alight to take the castings which are still red when stripped, is thus obviated.

No distinction is made in the silicon content whether thick or thin castings are made, which enables a metal only slightly charged with graphitic carbon to be obtained; and in view of the absence of oxides the latter is distributed uniformly throughout the mass in a pulverulent state, preventing the formation of cavities which cause breakages of continuity and are destructive of elongation and resistance.

The reheated metal has the following composition:

	Per Cent.
Graphitic carbon disseminated throughout the mass in the pulverulent state	0.90
Manganese	0.25
Silicon	0.40
Sulphur	0.03
Phosphorus	0.05

This metal gave the following results under mechanical tests: Resistance, 40 kilograms per square millimeter; elongation, 15 per cent. measured over 100 millimeters.

A metal obtained by the same process is capable of producing all the castings, whether thick or thin, with the following composition:

	Per Cent.
Combined Carbon	2.00
Manganese	0.40
Silicon	0.25
Sulphur	0.05
Phosphorus	0.03

Reheated for 72 hours in a dormant furnace at a constant temperature of 850 degrees Cent., without ores, the results under mechanical tests were: Resistance, 60 kilograms; elongation, 12 per cent. measured over 100 millimeters.

In this process the pig destined for conversion was obtained synthetically in the nonoxidizing cupola by the intimate mixture of 10 to 12 per cent. of ferrosilicon and miscellaneous scrap and waste.

At the present price of these materials with coke at 140 francs per ton, coal at 85 francs per ton, and electric power at 0.40 francs per kilowatt-hour, malleable iron castings or indirect steel can be produced at less than 100 francs per 100 kilograms. (About 4½ cents a pound at current exchange.)

As has been shown above the metal produced by this process possesses mechanical qualities almost equal to those of cast steel, but with the important difference that the castings are much cleaner in appearance.

These cast steels, it is true, give the following results under mechanical tests: Resistance, 40 to 50 kilograms and more per millimeter; elongation, 15, 20, 25 and even 30 per cent. over 100 millimeters. The castings do not always have such a good appearance and they may harbor hidden defects arising from bad manufacture. A manufacturer who employs the triplex process can produce simultaneously either direct cast steel, indirect cast steel, malleable iron or special steel or tempered castings.

CANADA MAKES GOOD SHOWING IN GREAT BRITAIN

Official monthly returns for the first quarter of 1922 indicate that British imports of passenger cars, trucks, and chassis are again on the increase, writes W. H. Park, secretary to the trade commissioner at London, England. The total number of passenger cars and trucks imported during this period was 2,495, valued at £461,328; chassis numbered 2,370, valued at £479,009. During the corresponding quarter of 1921 the total number of passenger cars and trucks imported amounted to 2,914, valued at £681,156; but imported chassis numbered only 963, valued at £314,863. Canada ranked first as a source for the number of finished cars and fourth with respect to chassis. France ranked second with regard to both finished cars and chassis. Italy was third for finished cars and first for chassis, while the United States was fourth in finished cars and third in chassis. Germany also made a good showing, although imports from that country were rather irregular.

A total of 2,448 automobile licenses were issued by the Province of Manitoba license department up to the end of April this year, according to statistics made public. Dealers' licenses total 244, motorcycles 465, chauffeurs 2,394, sales representatives 171, and permits 3,642. Revenue for the department so far this year amounts to $394,104, it is stated.

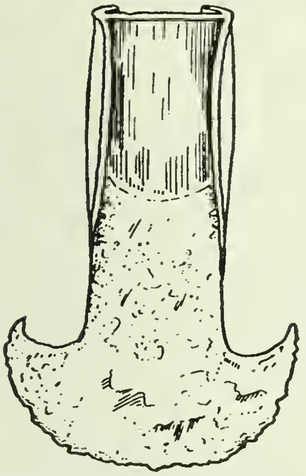
Development of the Metals After the Stone Age

Continuation of Former Article—Cast Bronze Axes Found in South America and in Ireland Show Mechanical Skill As Well As Great Age

By F. H. BELL

IN our last article we illustrated a badly corroded axe of ancient Greek origin with what was calculated to be an improvement in the mode of securing it to the handle. In the present article the first illustration is that of a bronze axe found in Ireland with precisely the same handle arrangement but with a much differently shaped blade.

How ancient this axe might be is hard to surmise, but it is a safe estimate to say that it dates back thousands of years. It is hard to believe that the inhabitants of Ireland were in possession of instruments of this kind at as early a date as were the Greeks, but here is proof abundant. That the idea might have originated in Greece is not doubted, but that the axe was imported from Greece is highly improbable on account of the entirely different design of the blade. Everything would seem to indicate that Ireland was populated with intellectual inhabitants, mechanically inclined, but with less inclination towards literature than the Greeks as early in the world's history as that of Greece. It is most likely that they had communication with each other or they would not have arrived at the same conclusion regarding the handle attachment.



IRISH

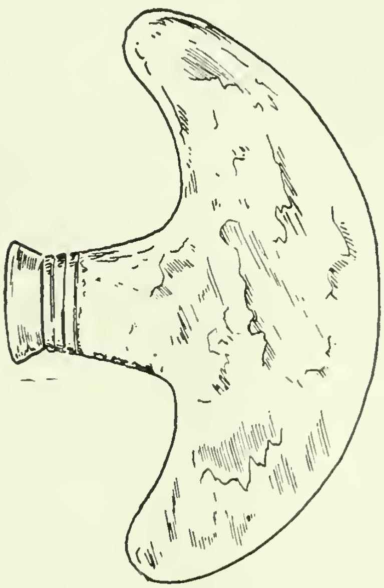
It also shows that they had some knowledge of foundry work. Most writers would have us believe that forging was practised for years before it was discovered that the metal could be melted. This would appear to be an unreasonable view for the reason that these old axes, particularly those shown in our last paper, which very closely resemble in design the stone ones which they succeeded are made of bronze. This bronze is a combination of copper and tin, the same as is used to-day and the ingredients must have been melted and mixed together before being made into the axes.

The Irish of that day, unlike those of to-day, were evidently not much given to education and did not leave us as good a history of their industrial pursuits as they might have done, and, were it not for the relics which are gathered together for museum purposes, we would, most likely, look upon Ireland as having a history dating back only a few centuries—certainly not beyond the time of Christ.

In the second view will be seen an axe found in Peru but with no known history. Its blade, while being much broader, is similar in design to the Irish axe. It is highly improbable that this axe was made by a race of men such as inhabited Peru when discovered by the white man. It was more likely made at a time when the country was inhabited by a race more akin to the Asiatic—most likely at a time when the two continents were more closely connected.

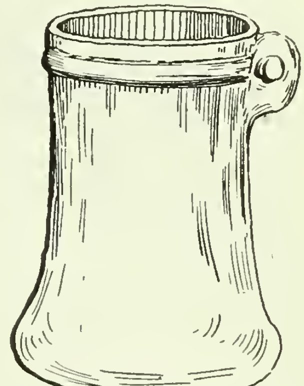
This axe, as will be seen, is to some extent ornamental. In fact it is of artistic design and is provided with an oval shaped sleeve at the top to receive the handle. This is the nearest attempt, so far, to the modern conception, that of having the handle fitted into the axe. The handle in this case would have to be bent to a right angle, but this would probably be accomplished by using a sapling with a portion of the root attached.

In the third view will be seen another Irish axe. This axe is considerably more modern than the former one, although it would date back to about 1500 B.C. It is neatly made and well preserved. Axes of this type are found in abundance throughout Ireland. It has a similar provision for handle to that of the Peruvian axe, and in addition has the eye at the front through which a strap or wire would pass for the purpose of securing the handle.



PERU

All of these axes are of bronze, demonstrating that, while iron may have been known it was not commonly used.



IRISH BRONZE

While the Irish axe shown in the first illustration is too badly corroded to tell how neatly it had been molded and cast, and while those shown in the former article were not intended to be anything but imitations of their rough stone predecessors, the latest one here shown is a masterpiece of metal work, both in regard to the quality of the casting, finish of the same and the general design of the pattern. The workmanship is equal to anything done at the present time, both the workmanship and the design being very similar to that done by the Chinese about four thousand years ago.

Egypt and Greece have long been noted for their ancient history, and no better evidence of their culture and the development of their mechanical skill is required than that which is to be seen in the bronze castings which have been unearthed, the axes being only one line chosen from the many.

The same can be said of Ireland's history, only that with the Irish so much tradition is included in their history that the world has come to look upon tradition as about all there is to Ireland's past, but with the evidence which the museum is in a position to adduce we are forced to the realization that Ireland was inhabited with a highly cultured race of people at least a couple of thousand years before the time of Christ.

(Continued on next page)

Single-Curve Gears of Thirty Teeth and More

Example Of Gear—Geometrical Construction—Peculiarity of Involute Gearing—Practice Is Suggested Before Taking Up Next Paper

SINGLE-CURVE teeth are so called because they have but one curve by theory, this curve forming both face and flank of tooth sides. In any gear of thirty teeth and more, this curve can be a single arc of a circle whose radius is one-fourth the radius of the pitch circle. In gears of thirty teeth and more, a fillet is added at bottom of tooth, to make it stronger, equal in radius to one-seventh the widest part of tooth space.

A cutter formed to leave this fillet has the advantage of wearing longer than it would if brought up to a corner.

In gears of less than thirty teeth this fillet is made the same as just given, and sides of teeth are formed with more than one arc, as will be shown in our next lesson.

Having calculated the data of a gear of 30 teeth, three-quarter-inch circular pitch as we should in our last lesson for one and one half inch pitch, we proceed as follows:

(1) Draw pitch circle and point it off into parts equal to one-half the circular pitch.

(2) From one of these points, as at B, Fig. 6, draw radius to pitch circle, and upon this radius describe a semicircle; the diameter of this semi-circle being equal to radius of pitch circle. Draw addendum, working depth and whole depth circles.

(3) From the point B, Fig. 6, where semi-circle, pitch circle, and outer end of radius to pitch circle meet, lay off a distance upon semi-circle equal to one-fourth the radius of pitch circle, shown in the figure at BA, and is laid off as a chord.

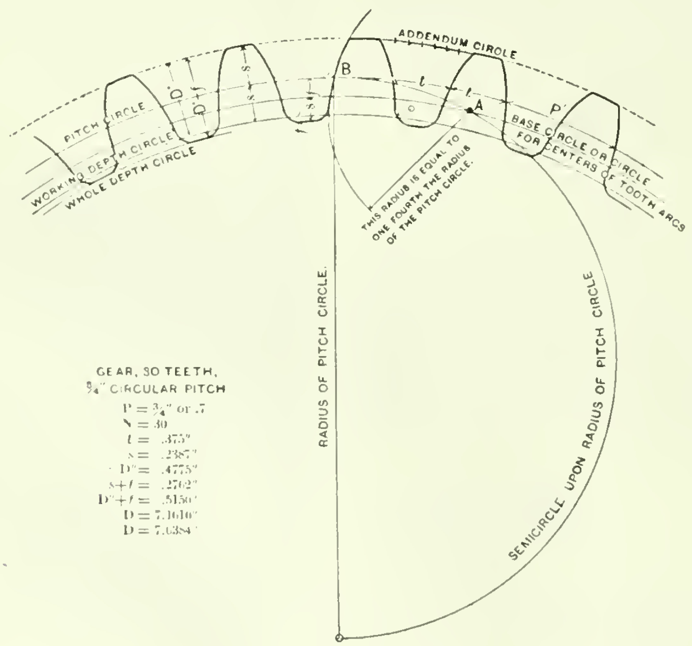
(4) Through this new point at A, upon the semicircle, draw a circle concentric to pitch circle. This last is called the base circle, and is the one for centers of tooth arcs. In the system of single curve gears we have adoptd, the diameter of this circle is 968 of the diameter of pitch circle. Thus the base circle of any gear one-inch pitch diameter by this system is 968 inches. If the pitch circle is 2-inch the base circle will be 1.936 inch.

(5) With dividers set to one-quarter of the radius of pitch circle, draw arcs forming sides of teeth, placing one leg of the dividers in the base circle and letting the other leg describe an arc through a point in the pitch circle that was made in laying off the parts equal to one-half the circular pitch. Thus an arc is shown about A as center through B.

(6) With dividers set to one-seventh of the widest part of tooth space, draw the fillets for strengthening teeth at their roots. These fillet arcs should just touch the whole depth circle and the sides of teeth already described.

Peculiarity of Involute Gearing

Single curve or involute gears are the only gears that can be run at varying distances of axes and transmit unvarying angular velocity. This peculiarity makes involute gears specially valuable for driving rolls or any rotating pieces, the distance of whose axes is likely to be changed.



SINGLE CURVE GEAR.

Pressure on Bearings

The assertion that gears crowd harder on bearings when of involute than when on other forms of teeth has not been proved in actual practice.

Practice Advisable

After reading the above and studying the drawing a good plan would be to make several drawings of gears 30 teeth and more. Say make 35 and 70 teeth 1½" P'.. Then make 40 and 65 teeth 7-8" P.'

An excellent practice will be to make a drawing on card board or Bristol-board and cut teeth to lines, thus making paper gears; or, what is still better, make them of sheet metal. By placing these in mesh the learner can test the accuracy of his work

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NOTICE TO PATTERN MAKERS

In the last issue of Canadian Foundryman in the advertisement of the Preston Wood Working Machinery Co., who manufacture pattern making machinery, there was an unfortunate error whereby an engraving of a band-saw was inserted accompanied by a caption referring to it as a buzz planer and jointer. A glance is sufficient to note that it was a misprint but it was, nevertheless, unfortunate, and we take this opportunity to rectify the mistake.

DEVELOPMENT OF THE METALS AFTER THE STONE AGE

(Continued from previous page)

Another race which is known to have a history dating back for several thousand years is the Chinese, but it may not be known that they were skilled workmen, and invented many of the things which are in daily use at the present time. It may not be generally known that even now they are in possession of knowledge, superior to any other race in the world, along certain lines. They excel in glass, porcelain and china-ware, silks and many other high class lines. They were the originators of printing and they invented gun-powder. In fact they did many things for which the world has forgotten to give them credit. However, they were early in the foundry business and many magnificent specimens of their handiwork are still preserved from remote times. Some of these will be shown later on, but in our next story we will show some of their axes, which, as has been stated, very much resemble those taken from Ireland, but show improvements on the Irish ones, which would probably indicate that they were of late origin, although known to be between three and four thousand years old.

The Iron Ore Resources of Northwestern Ontario

Not a Single Iron Ore Mine is Working in the Province of Ontario—Not a Pound of Ore is Being Used in Canada or Shipped Elsewhere From Those Mines

By JOHN D. McCALLUM

IF WE may judge by what has been written in periodicals within recent months, it is most certain that Canadians are fully alive to the importance of establishing the iron trade in Canada, on a basis sufficiently productive to supply our own needs in the first place, and afterwards, as a natural sequence, we shall take our place in the foreign markets, marketing our surplus, wiping off trade balances, adding to our national revenue, reducing unemployment to a minimum, and generally taking a new lease of prosperity.

The raw material in iron-ores has been found in varying grades and quantities in every province of the Dominion, but in none of the provinces are iron deposits found so liberally as in Ontario, and especially in that part known as Northwest Ontario. It is estimated that there are from five to ten billion tons of iron ore, lying near, or within a short distance of railway facilities, giving from 32 per cent. to 56 per cent. metallic contents. While it is true that the larger proportions of these ores are low grade, and contain a high percentage of impurities, it must be borne in mind that cast-iron without impurities has no commercial value. Our problem is to extract the metallic iron, with percentages of carbon, silicon, phosphorus, manganese, sulphur, in just sufficient quantities to make the iron merchantable, for the various uses to which it is put, and to do this quickly and economically so that the cost will compare favorably with the working of those ores of higher grade. That a solution of the problem is imminent, there seems little reason to doubt, for we know that Canadian metallurgists are working hard to effect this end, knowing as they do, that the matter is of the utmost national importance. Of all the iron ores found in the geological series, man has selected the two families, the Oxides and the Carbonates of iron, and of these two families, we are concerned only with the oxides, as being peculiar to North and Northwest Ontario and to Lake Superior region in general. Magnetites and hematites, two important branches of the oxide of iron are scattered by Nature with a lavish hand all over Northwest Ontario, and it only remains for us to use our brains, to make them serve the wants of mankind.

Various objections have been raised to the use of these ores in the past, one of which has gained so much currency that its mere mention seems to settle, once and for all, any attempt to make use of these enormous ore resources we have; that is, the excess sulphuric anhydride and sulphur contents, which most of the ores undoubtedly contain. Every other thing being equal, the experienced iron-master would not consider this an unsurmountable obstacle, for the reason that blast furnacemen are called upon to meet the difficulty of excess sulphur, not only from the ore content, but also when using a highly sulphuric fuel. The methods employed for the partial elimination of sulphur are according to the smelter equipment and the different kinds of ore at the disposal of the plant. No fixed rule is followed. Some prefer to use the gas liberating devices at desulphurization zone, others use a percentage of a highly managanese ore in the furnace burden. Manganese, as is well known, by chemical action in the furnace, is capable of absorbing up to 20 per cent. of the volume of sulphur in the ore and fuel. It may be interesting to observe that from the Atikokan range, giving an analysis; manganese .11 per cent.; the analysis of anhydride .50 per cent,; the analysis of the resultant pig-iron gives .025 per cent. in sulphur. This is well within .03 per cent., the limit suitable for making steel and would seem to prove conclusively that large deposits of ore in this region are workable, whatever the reason may be for complete stagnation of iron ore production in Ontario at present, it is not because our ores are not suitable for making merchantable pig-iron.

The last eight years have seen a gradual decline in ore produced and development work done on the well known iron ore properties in Northwest Ontario. Mining men have spent, it is estimated, over $100,000 in development work, without return, and have been discouraged to such an extent that very little work has been done for about five years, in diamond drilling, stripping, and proving any of the different claims. The Nipigon district is known as "the iron country" and not without reason, for almost anywhere the prospector goes, he strikes iron of a kind. Here are located the Onomonlake, Windigoken and Sand River iron deposits. Diamond drilling and stripping on locations A. L. 413 and 420 have proved large deposits of hematite one of good quality. An analysis of these ores gives iron contents: iron 46.91 per cent., phos. .098 per cent. At Little Pine Lake, in the South West part of the Nipigon Forest Reserve, is Little and Kelly's claim, proving a large body of magnetite assaying:

Iron	55.75	57.62	55.80	47.62%
Phos. ...	.0271	trace	.06	.05%
Sul.	.044	trace	.042	.04%

The Newcombe claims are located near Jackpine, on the Canadian National Railway, 65 miles east of Nipigon. Work done during the years 1916-1917 shows a large body of hematite ore of good quality.

In the Loon Lake district, 27 miles from Port Arthur, and only 2 1/2 to 4 miles from deep water shipping facilities on Thunder Bay, a large deposit of hematite ore was proved by diamond drilling, test-pits, and stripping. Average assays giving: Iron 48.85 per cent., lime 2.63 per cent.; phos. .019 per cent. Much of the ore in the lower series runs higher in iron, the average being iron 65.29 per cent., phos. .22 per cent. The Mokomon Range is 27 miles west of Fort William. The Matheson claims are located here, on the Canadian National Railway and extend to about 1,000 acres part of which is Iron Mountain which alone could supply ore to feed a dozen furnaces, for years to come. Being only 6 miles from the Kaministiquia Power Company's electric plant, at Kakabeka, this property is favorably situated regarding electric power. Magno-metric surveys, by the Dominion Government in 1916 indicate there is a large body of ore here. Development work shows very good results. Analysis of ore gives iron 43.02 per cent., sulp. .16 per cent., phos. .059 per cent.

The Anderson claims are situated in the same district and give iron contents as 42.65 per cent., sulp. 1.006 per cent., phos. .014 per cent.

On the Canadian National Railway in the township of Strange, is a deposit of hematite ore, belonging to Hogan, Jones, Lee and McAllister. What development work has been done shows a considerable quantity of ore of good grade, but enough work has not been done here to show the ore body. It is claimed that on these locations there is a soft ore on which a steam shovel can be used, but it is questionable if this advantage would make is more marketable, as such an ore would more than likely prove troublesome in smelting.

On the Matawin Range, 40 miles west of Fort William, the Dominion Department of Mines have made a thorough magno-metric survey of this range, and the owners of different properties have expended a very considerable amount of money in diamond drilling, sinking shafts, and stripping. This work has disclosed a very large area of ore, of which analysis shows:

Iron 58.68%	Phos. .21%	Sulp. .03%
Iron 60.63%	Phos. .18%	Sulp. 05%
Iron 38.90%	Phos. .13%	Sulp. .03%
Iron 38.64%	Phos. .16%	Sulp. .06%
Iron 37.98%	Phos. .14%	Sulp. .06%
Iron 39.12%	Phos. .14%	Sulp. .05%

On the Atikokan Range, 125 miles west of Fort William, on the Canadian

National Railway, is the Atikokan Company's property. Enough work has been done to show 11 million tons in sight and a large tonnage in reserve. The average analysis of ore for the last three years was:

Iron	60.24%
Phosphorus	.11%
Mangse	.11%
Lime	3.15%
Silica	8.54%
Aluminum	1.55%
Mangse Mgo.	2.59%
Sulphur	.50%
Copper	.12%
Nickel	.11%

On the same range, on location 26E, adjoining the Atikokan Company's property, the ore gives the following analysis:

Iron	67.32 %	68.35 %	63.90 %
Silica	2.05 %	2.63 %	7.25 %
Phos.	.06 %	.005%	.055%
Mangse	.90 %	.23 %	.44 %
Sulp.	.005%	.004%	.002%
Mag.	.23 %	.24 %	.15 %

The Pattison location, to the west of Atikokan Company's property, gives result as under:

Phosphorus	.027%
Iron	65.53%
Sulphur	.59%
Silicia	3.44%

To the west, along the Canadian National Railway, near Atikokan, Thomas Rawn and D. C. McKenzie have proven extensive bodies of hematite ore on claims G. 714 to 717 and 720, also 685 to 688 and on H. W. 724 to 726. At Bear's Pass, iron in quantity is found, analyzing iron 48.10 per cent., phos. .019 per cent. and sulp. .014 per cent.

The foregoing are a small number of the total iron locations in the vast area covered, but sufficient have been mentioned, to give some indication of the actual ore resources of Northwest Ontario. In most cases, the analysis in complete, but is clear enough to give an intelligent idea of the ore contents.

The contention that all these bodies of ore are useless, with the evidence before us, is absurd. Sooner or later we simply must put them to use. We may do so in the ordinary course of industrial expansion, or we may be driven to do so by economic reasons which at present appear on the horizon as a cloud no bigger than a man's fist.

A Pioneer Foundry in the Algoma District

Railroads, Mining, Saw Mills, Etc., Did Their Part in Building It Up To Its Present Dimensions—First Ore From the District Melted in Presence of Prime Minister

By JOHN WOODSIDE

IN the May issue of this paper we introduced a pioneer foundry in the district of Algoma, how it had to be rushed to completion in order to fill orders for the contractors on the construction of the Canadian Pacific Railway. This was at a time when this great undertaking was under way and when the city of Port Arthur was first springing into existence under the name of Prince Arthur's Landing. The buildings and equipment were nearing completion but the C. P. R. was also getting well advanced, the western section being done and the eastern section was being built along the shores of Lake Superior.—Editor.

The Railroad was heading straight for the Lake Cities, money was plentiful, and the gambler was not unknown; contractors made big earnings at rock work; and the lusty Swede at the muskeg station work; and they came to town seeking ways to spend it, and generally they found the way easy enough.

Deploring our delays to an old timer one day, he cheered me up with the remark, "Oh, cheer up; there are still a couple of years' building ahead on the C. P. R. and in that time we will all be rich and independent. But many things have transpired in the old town since those hopeful days to blight the hopes and retard the riches.

In the meantime the building had been erected, a two-storey building in the front for the machine shop, and pattern loft, though for a year or two the upper storey was mainly used as a store room, and the pattern-maker's lathe, and bench occupied a corner of the machine shop. The foundry was a lower building at the back, with cupola, scaffold, and fan within its walls, the scaffold being at the head of the "marsh" was handy to throw our foundry scrap upon, when as often happens, we wished to get it quickly out of sight. The cupola was about 28 in. inside, built of light plate, and topped above the charging doors with old glycerine tanks, obtained from the dynamite factory. The fan was an old ventilating fan from one of the mines, and not noiseless; it connected with the cupola by pipes running down either side; the tuyeres opening into narrow air spaces inside, which combination worked wonderfully well considering the mixed varieties of fuel we were sometimes compelled to resort to; we often took off considerable weight with fine stone coal, anthracite, but often badly mixed in quality. Close up alongside the cupola snuggled the brass furnace which always played an important part in the work. Various patterns had to be turned out on short notice; flasks made and a store of scrap iron accumulated, a great part of which was old stove plate; and our first supplies of pig iron were of the good old Scotch varieties, hard to beat for general use. We considered ourselves fortunate in discovering a supply of moulding sand on the terraces of the upper town and we dug it off the sides of the streets, but it proved worthless for heavy work, although it made a beautiful mould, it lacked bond and cut badly with the flow of the metal, however with the aid of clay wash, glue, and molasses, (sour beer was also available in those days), we made out with it for the first year, when we tried importing Hamilton sand for a time, but upon the opening of Port Arthur, Duluth, and Western R. R. we discovered a bountiful store of the necessary sand exposed in its cuttings, and after many years we are still drawing our supply from this source. In fuel our district is deficient, even in the solid charcoal common in the east; as for iron we are surrounded with it in its raw state, and a furnace established in later years produced a very good grade of foundry pig entirely from native ore. We are still hoping for a greater development of those ores. And in the new shop the cupola was erected, and duly lined up by pioneer hands; the old muskeg was covered by a foot of earth which packed good; the floors were formed up, and soon the sand heaps were added. The usual little ripple of interest attended the initial heat for the usual breaking in of the sand, but as we were only a small affair, and somewhat light in capital, although we were full of work, the town did not enthuse as freely as they have since over moneyed affairs coming to us though, in fact most of these have come with demands for the town to show cause why they should deign to come to our shores. But the little affair has weathered many a storm, and has kept up a respectable payroll for many years whilst heavier competitors have come, and gone. We opened with a flurry of work for the railroad contractors, a good paying line; and money was plentiful on the new road. The governments were bound to have a transcontinental line, and at times it seemed almost as though the national treasury was opened to the C. P. R. so lavish were the grants; and money flowed free for a while, and helped to secure the foundations of our enterprise. It is hard to freeze out a firm who can turn in and do all their own work in dull times, and be independent of outside help; but this had not been our ambition in starting this enterprise; our town had been hailed as the coming Chicago of Canada when it became the leading port at the junction of rail, and steamboat, and we had hoped soon to lead a small host of employees in the new field, but with the finishing of the road east came a slump, and we found ourselves left with a stock of manufactured goods, and no customers. Then came a period of mining activity when some of the richest silver veins of America were opened in our district; but the value of the metals proved variable, and the deposits shallow, and scarce had we adjusted our machinery to the new demand when they began to peter out. Once we missed a timely opening to a possibly good business. A little Englishman dropped in one day and proclaimed himself an electrical engineer; electric power was just then the newest sensation, and our town, hitherto depending on coal oil for illumination, and steam and horse power for transport, was beginning to take interest in the new, and wonderful power. To fill in time, we gave the wanderer the contract to build, and instal a small plant for lighting the shop; this proving a success the electrician encouraged us to bid for a town plant, guaranteeing that he could fill the order, but lack of faith in the small shop, and some hostility to us, amongst the then town rulers, who may have received propositions from foreign manufacturers, checked us up; and an outside firm was favored with the contract soon after let. Thus passed the opportunity to have branched out into a rapidly growing industry, beneficial to both the new shop, and also the town; and our engineer went on his westward way and, later, we heard, made good in a more appreciative western town.

But railroad building was not done yet; the great Whitefish Valley demanded a line for its mines, forests, and agricultural lands, and the building aided us materially, and this proved but the start of another great transcontinental line, the Canadian Northern, which made our town their headquarters as the C. P. R. had settled theirs over in Fort William and thus year by year we hung on, sometimes by teeth and claws, or progressed as times favored us. Elevators grew and multiplied around us, and came to stay. Saw mills arose in our town and added to our income, and passed away in smoke, or quit as their timber limits were exhausted. We took a liberal toll from our marine despite the building, and equipping of a first-class dry dock in our town. We stripped mines of the machinery we had helped to install in more prosperous years, and moved it to newer fields.

Death came and took its toll of the old firm, but a new generation grew up to take the vacant places, and the firm still lives, after a rather strenuous 38 years of existence, under the same old and honored title. We still help ourselves freely of the native sands of our not far distant plains and hills. For a time we used coke made in town, though of American coal; and for a time we used pig iron smelted in town from our native ores. And we look for a greater development of those ores in the not distant future. Our flasks were made from our native wood, red and white pine, spruce, or tamarac, or of the more common, though neglected poplar, or cottonwood. And through it all a two ton ladle, and a medium sized jib crane has filled our utmost needs; though we sometimes promise a waterproof pit, and an overhead crane. But Port Arthur has long ago accepted us as a concern come to stay until we move out to the beautiful resting place of the city's dead.

One scene in the old foundry remains forever fresh in my mind; it was upon the occasion of a visit to our district of the late Premier, Sir Oliver Mowat, during the latter years of the old century. The development of our iron ore was an important question then, as now, the P. A. D. & W. R. R. had been carried beyond the international boundary, at Gunflint, to open up a deposit of high grade ore, which would mix well with our lower grade ores nearer home; so we determined to mark the visit of Sir Oliver by an event of historical importance; no less an event than the smelting of the first iron in Algoma district. A car of ore on the way down was met at Whitefish by an enthusiastic crowd escorting the, almost royal, visitor, where the scene was duly photographed, and reported. I had been at work on the little cupola, cutting a slag hole, and by great good luck had discovered a supply of limestone at a local stone-cutting plant; so when we were all ready for the blast, the visitor was ushered in and given a seat of honor opposite the furnace, and well out of danger from sparks and fumes, where he sat in state, surrounded by a more or less patient committee of entertainment, while we charged coke, and limestone, and iron ore reported to be 65 per cent. ore, and blew until slag flowed in glowing streams, and we secured a scanty store of iron, but enough to cast several mementoes of the occasion, which were distributed amongst the honored guests; and there all through dust, heat, and smoke the honored guest sat with his usual bland smile, and when the ordeal closed expressed himself as feeling much honored by being the guest upon such an important occasion. However, if I remember right he closed the incident without promising "to give it his very best attention." In 1903 the plant was almost completely destroyed by fire but as quickly as an adjustment of insurance could be obtained we were at work laying cement foundations this time, outside the old timbers, which had in most cases pretty well rotted away, as we intended to somewhat enlarge the plant; and soon a much larger, and better, building arose around the old ruins. In the meantime, as the brass furnace, and also the core oven remained, I took advantage of the fine weather to do some open air moulding, and casting, as they enclosed the old floors by the new walls. The old fan, and scaffold had been consumed, and the cupola so much damaged that we installed a new outfit on a larger scale. The core oven which served us for many years, and baked many a ton of cores, was unique in design; at first the shop heater had to do duty as a core baker, but happening upon a medium sized marine boiler, which had seen service as a toter of supplies to the railroad builders of the C. P. R., but had been abandoned upon the completion of the all rail routes we took possession, and "gutted" it pretty thoroughly, removing flue sheets and flues, and putting in a tight floor above the furnace box, it proved a handy, and effective core oven, using either wood or coal fuel; may its old bones rest in peace. It survived the fire, although it could not save its load of cores which were found burned to their original dust, it has been superceded in later years by a larger brick oven with car, and track, and the necessary room for larger cores. We have faced the handicap of long and severe winters, sometimes suffering freeze-ups and always running up a heavy fuel account, but with an average of about 20 on the payroll, for which it provides homes, and comforts, as well as filling an important place in the repair work of surrounding plants; it is still open for business on the old stand, and may it long hold its place in the goodwill of its employees and the patronage of the public. Au revoir.

FINDS BUSINESS BETTER IN OTTAWA

A survey of the machinery and metal trades in the Ottawa district shows rather a contradictory state of affairs for, whereas trade in medium work appears to be "booming," trade in large work is decidedly quiet, and small work is sandwiched in between the two, being fairly good. Of these machine shops specializing in medium work which were visited, all report trade either good, improving, or excellent. McMullen Perkins Ltd., have been enjoying a big volume of business. This firm installed two new grinders and a new lathe last year but their business is such that they are putting in another new grinder and have taken on two extra hands. Mr. McMullen reports that even in the usually slack months of January and February the works were kept going at full capacity and that he was employing more men than at the busiest time last year. Armstrong & Co. is another firm in the booming category. Mr. Armstrong has recently taken on two extra hands and is putting in a new grinder, three more lathes, and a new milling machine, which, when installed, will call for the employment of an additional three men. This firm finds its present premises altogether too small for its growing business and, as already announced, has secured a site on which an up-to-date large machine shop will be erected at once.

Mr. Lawson, of T. Lawson & Sons declares business to be improving. He has increased his staff by two but says that as yet the volume of increased trade is not sufficient to warrant the installation of any new equipment. The Victoria Foundry reports business as quiet with no large contracts in sight. Business in supplies is rather above the average.

Selecting Rubber Goods for Use in the Foundry

Hose Should Be Made of Material Which Will Bend Easily and Not Kink. Soft Tube Will Outwear Hard Tube for Sand Blast Use

Contributed by Foundry Equipment Manufacturers' Association

LEAKAGE, waste of power and higher operating cost may be traced directly to the use of unsuitable hose and other forms of rubber equipment. The subject may be considered under 12 general heads: (1) Hose for vibrators on folding machines. (2) Hose for pneumatic tools. (3) Hose for air hoists. (4) Hose for sandblast barrels. (6) Hose for wetting down the sand and other requirements. (7) Hose for paint spraying machines. (8) Hose for acetylene and oxygen. (9) Rubber gaskets for sandblast barrels. (10) Rubber cloth inserted sheets for lining sandblast chambers. (11) Hose for pneumatic sand sifter. (12) Hose for revolving steel brush.

Compressed air is more costly than the power used to produce it and therefore its efficient use deserves as much attention as that bestowed on steam, water or electric current. A leak in the air line, or excessive use at a motor will not endanger the operator. In this respect it differs from steam which beclouds the view, electric current some times responsible for a shock or burn and water which floods the premises. Nevertheless, to save the coal pile, careless and wasteful methods of handling compressed air should be eliminated. To do this several basic features should be kept in mind. Leakage at couplings, or through the hose never should be permitted to exist. They can be prevented by the proper application of gaskets in connection with the couplings and by exercising care in the selection of the hose itself.

Pressure which the hose will stand is inversely proportional to its diameter. As the inside diameter of the hose increases, the pressure it will stand, decreases. A 1-inch 6-ply hose may have a bursting pressure as high as 800 pounds, while a 2-inch, 6-ply hose made of the same materials would burst at 650 pounds. Hence care always should be taken to specify greater number of piles for the larger sizes.

To secure good, economical service, air hose must not kink. Kinking not only shuts off the supply of air at the time, but it creates a permanent injury in the wall of the hose, which later develops into a leak. To prevent accidents of this character, the thickness and number of plies must be proportioned to the size of the hose; the rubber must be of good quality and the inner tube, fabric and outer cover must be properly proportioned to each other.

Sometimes customers specify wire winding as a protection against outside wear. The practice is not recommended. It makes the hose heavy and hard to handle. Once bent, the hose is hard to reshape and a wire covering is more costly than the thick rubber cover recommended as the best protection for the outside of the hose.

A molded hose is advisable for any length over 50 feet. This type of hose eliminates extra couplings which retard the flow of air and decreases the pressure at the tool. This is an important feature. It has been found that a 15-pound increase in pressure can make a 37 per cent. difference in the amount of work accomplished by the tool.

Vibrator Hose

Air hose used in connection with vibrators on molding machines usually is, 5/16 or ⅛-inch and should be of the best quality with a good resilient oil proof tube. It also should have a cover of resilient rubber and the walls should be heavy and substantial. This hose is not subjected to external abrasion, but the cover and wall must be heavy enough to absorb the continued bending without kinking or cracking. The outside sometimes is chafed off by scraping the hose over machines.

Pneumatic Tool Hose

Hose for chipping and other pneumatic tools, also should be the best procurable. It is subjected to the hardest use, dragged over rough castings, run over by trucks and abused in general. The cover should consist of about a 1/16-inch thickness of tough rubber. Until recently the practice was to use a ¾-inch hose wire wound for the line, with a short length of ½-inch hose, not wire wound, on the end and termed the leader. At present the practice almost exclusively is to use a ½-inch hose without wire windings. A good rubber cover will withstand more abrasion than wire. Wire makes the hose heavier and in addition it becomes flattened when a casting drops on it or a truck passes over it making it necessary to hammer out the kinks. The automobile tire furnishes a good illustration of this feature. The trend certainly gets its share of abrasion. Tough rubber has been found the best protection against this abrasion. Metal studded tires have not proved successful. The character of the tube, or lining, of hose used for this purpose is a most important feature. It should be oil proof, high grade and firmly anchored or vulcanized to the fabric. Oil proofing tends to prevent the ends from becoming soggy and soft through the action of the oil and, what is more important, it prevents decomposition of the tube throughout the entire length of the hose. Oil will affect a poor tube seriously and then small particles of rubber become loosened and are carried to the tool preventing proper functioning of the air ports.

In large foundries many feet of air hose are under pressure at one time. Leaks in the hose mean loss of coal and power. It also means a slower functioning of the tools. Leakage may be divided into three classes: leakage of new hose, leakage of hose which has been in service from three to six months and leakage of old or broken hose. The latter is most easily detected and may be remedied at once, but the other two conditions are apt to create more trouble. After a series of exhaustive tests a prominent mining journal concluded that even new hose leaks although so slightly that the leaks cannot be detected in the usual manner. It was found that new hose which enlarges most in diameter under pressure, leaks most. Therefore it is advisable to install hose so constructed that the pressure will elongate it but not increase the diameter. This feature is governed on braided or woven hose by the angle of the threads in the braiding.

Hose three to six months old requires the closest watching. Particular attention should be directed to hose apparently in good shape and presenting no cuts or warning breaks. Time after time, hose in this condition has been tested by placing it under water and has been found to be full of little pin holes. This species of leak cannot be detected in any other manner. In a foundry where a few thousand feet of this kind of hose are under pressure, the condition will be reflected definitely in the coal pile.

Air hose for hoists and other pneumatic tools would require the type of hose recommended in the foregoing. In some cases a somewhat cheaper hose might be used but the practice is not recommended. The fact must be borne in mind that when a good hose and one of inferior quality are carried in stock, men are apt to apply the cheaper hose where the good one is needed. This practice may prove disastrous, but where all air hose is good hose, no harm can be done by using it on all appliances and even on the easier jobs it will prove eventually economical.

Sandblast Hose

One of the paradoxial points about sandblast service is that the softer the tube of the hose, the longer it will wear. The resilient rubber compound resists the abrasive action of the sand which wears away hard substances rapidly. The tube of the hose also must be smooth, because if there is the least roughness at any point, the wearing action will begin there. Flexibility also is important and the wall of the hose must be thick enough to prevent kinking, because the least kink in a sandblast hose means rapid destruction. For economy in this service, hose should be selected which has a thick inner tube of the best rubber and a good thick wall which is at the same time flexible and springy. Sandblast hose should be of a character that will hold the pressure and at the same time resist the abrasion of the sand. Until recently sandblast hose generally was furnished with a ⅛-inch lining and with 4-ply duck. Later investigation has demonstrated that a 3-ply will hold the pressure in most instances where the hose is from 1 to 1½-inch inside diameter. On a ¾-inch inside diameter 2-ply will do the work.

When the tube or lining is worn through, the plies of duck are useless in resisting the abrasion of the sand, they will give way at once. Therefore what was saved in cutting down the number of plies is utilized in providing a heavier and better lining. Good sandblast hose should have ¼-inch lining for practically all sizes and the plies should be as follows: ¾-inch, 2-ply; 1-inch, 3-ply; 1¼-inch, 3-ply; 1½-inch, 3-ply and 2-inch 4-ply.

The tube is the heart of the hose. It should be pure gum, tough and resilient so that when the sand strikes it the lining will yield. The sand then will rebound. If the tube does not give, but resists the sand it will quickly be worn away just the same as the casting that is being sandblasted. It does not necessarily follow that all soft tubes are good. They are not. They must be soft, yet tough. A cheap rubber can produce a soft tube, but pure gum and zinc are necessary to produce a soft, tough tube. Whenever sandblast hose is subjected to a bend the wear will be most severe at that point, because the tendency of the blast is to go straight. This condition exists generally at the wall connection where the blast enters the hose. At this point the lining often is worn away completely on one side while still intact on the opposite side. The life of the hose may be extended by giving it a quarter turn every few days so that all sides of the lining will be subjected to the blast and thus wear uniformly. Air hose for a sandblast barrel usually is used in short pieces and generally in a bent position. The sizes vary from ¾ to 2 inches. For this purpose the type of hose specified for pneumatic tools is recommended.

Hose employed for wetting down the sand and for other purposes around the foundry generally is used in ½ and ¾-inch size. A good garden hose will serve satisfactorily as it is apt to get burned or damaged in some manner before it is worn out. Large castings made in many foundries are painted by a spraying machine. The paint hose practically is a good air hose but of somewhat lighter construction which makes it easier to handle with a small paint gun. Both tube and cover should be of good rubber, oil proof and paint proof. This hose usually is used in ¼, 5/16 and ⅜-inch sizes.

Manufacturers sell a hose with a black cover for connection with oxygen tanks and one with a red cover for the acetylene tank. This hose is a high grade air hose but lighter and more flexible for convenience in handling with small burners. The tube or lining should be of the best rubber, as it has a tendency to deteriorate, particularly from the effects of the acetylene. It is supplied in diameters from ¼ to ½-inch.

Sandblast barrels require gaskets, square and round, of various sizes. The stock should be a good, medium, soft rubber. The gaskets vary from 1/16 to ¼-inch in thickness. They prevent the dust from coming out of the revolving barrels. The covers are removed frequently and therefore a high grade rubber is recommended that will not harden quickly and fail to make a tight joint after the cover has been removed a few times.

The usual sandblast chamber is a small room enclosed in sheet metal. Castings are loaded on trucks and run into this chamber to be cleaned. During the operation part of the blast strikes the walls and eventually wears holes. To prevent this, the walls are draped with rubber sheets about 3 feet wide, 5 feet long and 1/16-inch thick. Originally this rubber sheet was not reinforced and as a result the pieces tore long before they were worn out. In recent installations the rubber sheeting is reinforced with a single ply of fabric and probably will last indefinitely. The rubber should be of good quality and reinforced with light weight duck.

Couplings similar to those made by the Cleveland Pneumatic Tool Co. and by the Chicago Pneumatic Tool Co., are recommended for air hose. They do not require any bands. A special coupling is provided for the sandblast hose which should be attached with a heavy clamp of cast material, for instance, Brantford hose clamps. Special connections usually are furnished by the manufacturer of the machine for the paint hose and the oxygen hose. In all cases where couplings are applied at the plant, care should be exercised to see that these couplings are not forced into the hose and that there are no burrs on the end of the shank. If the shank couplings are treated with a little rubber cement they will go easily into the hose and stay there.

CLAY TO OUST CAST IRON

The following article, while not a foundry proposition is of vital interest to foundrymen since it shows how one branch of the industry is being threatened. It was sent to us by Mr. R. S. Clark, secretary of the Carnegie Institute of Technology, Pittsburgh, Pa., who will be pleased to send the entire article from which this was abstracted to anyone who requests it.

Cast iron has been attacked from many quarters but is still in the ring, but it is always well to keep an eye on opponents and not be outdone.

As a result of laboratory tests made in the College of Industries of Carnegie Institute of Technology, Pittsburgh, it has finally been established that bituminous clay pipe for drainage and sewerage use is in every way the equal of the more expensive cast iron pipe which has been employed heretofore.

For years efforts have been made by manufacturers and engineers to find methods of efficient substitution of bituminous clay pipe for cast iron pipe, but without success. One weak point has invariably remained an inability to join the lengths to prevent leakage. Practically speaking there has been but one general type of jointing material used, some variation of the ordinary building cement.

Recently various bituminous compounds have been evolved as a substitute jointing material. But the first—and numerous—tests made of these, too, failed to overcome the great weakness of clay pipe when used for drainage or sewerage.

Finally a number of these bituminous compounds were placed at the disposal of S. E. Dibble, head of the Heating and Ventilating Department of the College of Industries of Carnegie Institute of Technology. He proceeded to make painstaking and unusual tests and experiments. He not only devised absolutely new equipment with which to simulate actual drainage and sewerage conditions in the making of his tests but as a result of the tests themselves he developed an entirely new jointing practice and technique. Altogether twenty-one separate tests on a total of sixty-three joints were made, three different bituminous compounds being used.

Not only have Professor Dibble's tests established (1), that a proper bituminous compound can be used efficiently in jointing a pipe; (2), that joints made in the manner developed by Professor Dibble will stand any pressure that the pipe itself is capable of standing, without showing any leak; (3), that a pipe line so jointed can be thrown out of alignment without causing a leakage at the joints; and (4), that leaks due to poor workmanship can be repaired easily and quickly; but Professor Dibble has gone further and has published actual chemical analyses of two of the bituminous compounds found satisfactory.

Industry in a score of its important fields will immediately profit by this practical type of educational institution work.

The "Brass World" states that Joseph Jenks was the first foundryman on the continent of America who worked in copper, and that this was in the year 1645.

S. S. MOORE, Managing Editor
F. H. BELL, Editor

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

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Conditions in General

THAT CONDITIONS in every respect are better than a month ago goes without saying, but it is equally true that they are not much better. A prominent foundry supply man put it about right when he said that each month since the first of the year was noticeably better than the one which preceeded it but the difference was not great enough to portend any rush in business before next spring. This does not mean that unemployment will be rampant during next winter, but it means that things will not be where normal thinking people think they should be until next spring.

This is, at least, a safe view to take, but it is not what history has taught. Unless the ways of the world have changed from their usual routine, the quiet times are about at an end and busy times will come with increased rapidity each month, and by the end of this year's harvest we will be enjoying bright times which will be a surprise to most of us. As a matter of fact things are better now than some of our biggest men care to admit. The farmers who have avoided buying for two years see a good crop ahead of them, and the two facts combined have resulted in their making purchases which were due before. The agricultural inmplement shops are quietly running along with practically a full complement of men while gradually emptying their store-houses. As we pointed out on former occasions the building trade was never so good in the history of the country. Every city, town, and village is having its building boom. This, of course, reflects into foundries catering to this class of work, which in turn creates more business. The one class of foundry which does not appear to be making much headway is the class which does heavy machinery. So far these shops are almost at a standstill, but on the whole conditions are far better than they have been in two years. Coal strikes and threatened railroad trouble make both buying and selling unsatisfactory while the labor situation in all lines is not any too stable. A cut in wages is never welcomed by the working man, particularly when he sees nothing in return for it, yet cuts in wages seem to be the only thing which employers can see to bring back prosperity. The amount of a man's income is not of any concern. What he can purchase with it is what counts. However there is very little strike talk among the foundry workers and it is altogether improbable that there will be, and things will soon be moving along as of old.

American Versus British

IN OUR LAST issue we published a somewhat lengthy paper entitled "American Versus British Gray Cast Iron" read at the Rochester Convention by Mr. F. J. Cook, a foundry manager from the Birmingham district of England. It is to be hoped that it was read through and carefully studied by every reader as it was alive with interesting and educative matter. Of course, it brought out the British side of the question in a most favorable light. The Americans were interested in it because it enlightened them on a number of points in British practice as well as opening their eyes to what is going on in their own country. While they appreciated it and took their medicine like good fellows, it was not to be supposed that they would absorb everything as gospel and let it drop at that. There was an American side which had to be brought out and presented to the public for consideration and then as a matter of fact all Englishmen do not see things alike.

In the present issue we publish an ably written paper by an eminent English authority as well as a couple of replies from well known American metallurgists. These are all equally as interesting as the original and while the discussion is between English and American foundrymen the information which is being brought to light is of equal interest to Canadians and we trust that they will not be scanned over but carefully and studiously read through. We have some more papers written by prominent American metallurgists on the same subject which will be pubished in future issues.

British Foundrymen's Convention

THE INTERNATIONAL Foundry Trades Exhibition which was held at Birmingham, Eng., June 15-24, was a decided success. Our British representative puts it thus: "Owing to the prolonged labor trouble in the Engineering trades very many people who ordinarily find it difficult to get away from their plants were free to attend. Luckily the labor troubles which brought the metal working trades to a stand still were settled just at the time the exhibition opened which encouraged buyers to go forward and place orders. Exhibitors were well satisfied with business done, and the general atmosphere was decidedly encouraging."

A feature in British methods of having an exhibition is that they not only exhibit what a foundryman would be likely to buy but they also exhibit what foundrymen have to sell. By this means it becomes of interest to a class of foundrymen who might otherwise not see in it any good. Among the exhibits were samples of malleable iron castings, steel parts for ships, gearing, marine cylinders, etc. This class of exhibit helps to swell the number in attendance and as a result creates a bigger number of possible buyers for the foundry equipment and supplies which are on exhibition.

The convention proper, which only occupied three days, June 21-23, was somewhat along similar lines to the American Foundrymen's conventions but savoring of British custom. The practical part of the foundry held a prominent place in the program. Exchange papers were also read. Following are the papers which were presented and discussed: "History of Loam Moulding in the Province of Liege," by J. Varlet, of the Esperance Longdoz Works, Liege, Belgium; "New Methods of Testing Cast Iron," by E. V. Ronceray, M.I., Mech. E., Paris; "American Methods of Manufacture of Malleable Iron Castings and Some Data in Connection With the Finished Product," by Enrique Touceda, Albany, N.Y., U.S.A.; "The Development and Manufacture of High Tenacity Brass and Bronze," by O. Smalley, M. Inst. M., Newcastle-on-Tyne, England; "Some Influences of Low Temperature on the Strength and Other Properties of Cast Iron," by A. Campion, F.I.C., of Falkland and J. W. Donaldson, B. Sc., A.I.C., of Greenock; "The Manufacture of Light Steel Castings," by H. Bradley, Sheffield; "Semi-Steel," by J. Cameron, Kirkintilloch; "Safety Work in Foundries," by R. W. Patmore, of the Industrial Welfare Society, London, England.

These papers, as their titles and the names of their writers imply, will be particularly interesting reading and will be published in future numbers of Canadian Foundryman.

Market Conditions

CONDITIONS in the metal market are practically the same as a month ago in regard to price, although the demand for pig iron has been greater and more iron is moving. In the non-ferrous metals the enormous stocks on hand at the close of the war prevented any high price being asked. In fact the price of copper was lower than in many years. The demand has however been greater than was anticipated could be possible and at the present time there is very little of this material in reserve. There is quite a bit of scrap metal on the market but no more than is required. Core is to some extent hard to get, as it is a product of the bituminous coal mines where the deadlock between the two opposing parties has not yet been broken. The following prices are quoted this week: No. 1 Pig iron, Toronto $29.15; Gray forge, Pittsburg $25.00; Lake Superior Charcoal iron, Chicago, $30.00; Standard low phosphorus, Philadelphia $13.50; Bessemer, Pittsburg $25.00; Basic. Valley furnace $24.00. The following selling prices are quoted for non-ferrous metals on the Toronto market:—Lake copper. $17.00 per cwt.; Electrolytic copper, $16.75; Casting copper $16.50; Tin $34.00; Aluminum $21.00; Antimony $7.40; Zinc $7.25; Lead $7.00; For scrap metals Toronto dealers are paying:—Copper $11.00; Heavy machinery brass $9.00; Machinery brass turnings $6.50; Yellow brass clippings $6.00; Yellow brass turnings $4.85; Medium brass $4.50; Light brass $3.50; Aluminum $11.00; Zinc $4.00; Heavy lead $4.50; Tea lead $3.00.

For good machinery cast iron dealers are paying $16.00; Stove plate $14.00; Car wheel $16.00; Malleables $11.00; Cast borings $5.00; Coke is quoted in Toronto at $12.75 per ton in car load lots.

Ontario's Iron Ore Deposits

AT A CONFERENCE which was called by the Hon. Mr. Mills and held at the Parliament Buildings, Toronto, on July 5th for the purpose of ascertaining what were the possibilities of making use of Ontario's extensve iron ore deposits, and at which most of the furnaces of the Dominion were represented, the following questions were asked:

(1) The extent of the iron ore deposits of Ontario. Are they sufficient to sustain a native blast furnace industry of importance?

(2) The kind and quality of the deposits:
  (a) The iron ores of Eastern Ontario.
  (b) Deposits of banded magnetite, or mixed magnetite and hematite.
  (c) Silicious hematite.
  (d) Siderites.
  (e) Bog iron ores.

(3) (a) The applicability of magnetic concentration methods for low grade magnetites, and subsequent briquetting or nodulizing.
  (b) Processes for increasing the metallic content of silicious hematites.
  (c) The roasting and nodulizing of siderites.

(4) Are all or any of the above, or other methods of beneficiation within permissible limits of cost?

(5) How far can a market be found in Ontario for beneficiated Ontario ores?

(6) Is there a market for more than the present pig iron product of Ontario? If so, where?

(7) Can the problem be attacked by adapting a method of reduction to low grade ores, rather than by treating the ores so as to make them amenable to present blast furnace practice?

(8) Any aspects of the question not enumerated above.

These were responded to by different furnace men and others who were present, but not in a very favorable manner. The furnace men agree to use our own ore in preference to imported ore providing they get value for their money, and this is the question which must be settled.

In our next issue we will have a report of what progress was made. In the present issue there is a very interesting article on the subject by Mr. John H. McCallum, of Fort William, who is an enthusiastic advocate of getting these mines under way. Mr. McCallum has had mining and metallurgical experience of considerable extent and his views will have much weight.

Black Finish on Brass

FOR the purpose of producing a black finish on small brass articles, says Mechanical World, it has been found that a sulphocyanate solution having the following composition is satisfactory:—Nickel ammonium sulphate, 8-oz. per gallon; zinc sulphate, 1-oz. per gallon; and sodium sulphocyanate, 2-oz. per gallon. It is desirable to keep in suspension an excess of zinc carbonate, which maintains the neutrality and the zinc content of the solution. "Black nickel" plating may be applied successfully to brass, either directly or after copper plating, to copper, and to steel which has been first coated with copper, nickel, or zinc. Where protection against corrosion is desired, the "black nickel" should be preceded by zinc plating. The wearing properties of the "black nickel" surface are largely determined by the quality of the lacquer subsequently applied.

The Volta Manufacturing Co., Welland has just received an order from Renton & Fisher of the Hopetown Steel Works, Bathgate, Scotland, for a standard three-ton capacity electric steel furnace, with transformers and switchboard equipment complete.

* * * *

Steel trough and Machine Co., Tweed, Ont., are constructing a large addition to their plant in that city, which will add five thousand square feet to their floor space. This firm manufactures foundry tote boxes, waste cans, shop barrels, gasoline tanks and sheet steel sundries of any kind required.

* * * *

The Preston Woodworking Machinery Co., Preston, Ont., have secured the contract for the pattern making and other woodworking equipment to be installed in the new technical school at Sarnia. The list includes five lathes, ore grinder, band saw, buzz planer, variety saw, surfacer and mortiser.

* * * *

The Pease Foundry Company, Toronto, whose plant at Brampton, Ont., was badly damaged by fire a few weeks ago, are again running full blast, having rushed reconstruction of damaged portions. They report that they are very busy and are running full time with a full compliment of men.

* * * *

The British Empire Steel Corporation will spend nineteen million dollars in additions and repairs to their steel plant at Sydney, N.S. Engineers employed by the corporation are now engaged preparing plans for new open hearths and blooming mill which will cost in the neighborhood of ten million dollars. One blast furnace is to be rebuilt and a second one extensively repaired.

* * * *

The Canton Pneumatic Tool Co., Canton, Ohio, are circulating their catalogue describing and illustrating their valveless hammers, scaling hammers, chipping hammers, riveting hammers, etc. The contents show all details of the valves used on such tools as have valves, how their external valve operates, how the piston acts as valve and striking member on the valveless hammer. Pneumatic drills and riveting machines are shown as are pneumatic foundry rammers for both bench and floor work. Specifications, tables and other information are included.

A big strike of gold is reported to have been made on Blue Lead Creek, sixty miles from Quesnal Forks, B.C., adding to Canada's known enormous gold deposits which are now the greatest in the world.

* * * *

The Callender Foundry Co., Guelph, Ont., are taking over the charter of the Callender Foundry and Manufacturing Company, Limited, and will carry on business under the new name hereafter. They have added a machine shop to their business and are manufacturing conduit fittings as a specialty while continuing to operate the foundry as a jobbing shop. They report that they have found business fairly satisfactory during the quiet spell which is just taking its departure. They have been running from four to six days per week right along.

* * * *

The Aluminum Last and Metal Company is a new industry which has just started operations at Kitchener, Ont., by James W. Watson, formerly proprietor of the Kitchener Pattern Works, and Albert Wendling, formerly foreman with the Forewell Foundry Co., Kitchener. Both are first class mechanics and well known. They are manufacturing aluminum shoe lasts and have a well appointed foundry for the purpose, and are prepared to fill orders for aluminum castings as well as brass, bronze and special alloys. The pattern making department will still be operated.

* * * *

P. H. & F. M. Roots Company, manufacturers of blowers, gas pumps, water pumps and vacuum pumps, Connersville, Indiana, are issuing a large and attractive catalogue describing and illustrating their rotary positive blowers. A feature of the book is that they have omitted all testimonials and all pictures of installations, and have devoted the entire space to practical information. The reproduced drawings of the interior of the blower are particularly interesting, as are the tables of sizes and pressures. The instructions for selecting proper size of blower and for keeping it in repair are well worth reading.

* * * *

E. Rupay, who was for many years employed with the Raymond Sewing Machine Company of Guelph, and later with the White Sewing Machine Co., has accepted the position as foreman with the Electric Fittings and Foundry Co. at their Preston, Ont., plant. This company manufactures conduit fittings and are preparing for a big demand which their experience has taught them will be the result of the present building boom all over the country and as a consequence are installing a lot of new equipment. In their machine department they are putting in a new "Petrie" shaper and two powerful punch presses.

* * * *

There is a distinct and steady demand in Belgium for Canadian hand tools of a great variety of types, says A. S. Bleakney, trade commissioner at Brussels. If Canadian firms can lay these tools down at prices which will compete with the United States tools on the market, says Mr. Bleakney, they can undoubtedly do business. Certain Canadian tools, including saws, hoes, rakes and forks, are already on the market, a fact which should encourage other Canadian manufacturers of tools to endeavor to supply a share of the hand tool requirements of this country.

* * * *

The Electric Furnace Construction Co., 908 Chestnut Street, Philadelphia, manufacturers of Electric Furnaces, "Electro" Steam Boilers, etc., report an increase in capital and the appointment of the following new officers: Mr. P. H. Falter, vice-president and treasurer; Mr. Arthur G. Dickson, of Dickson, Beitler & McCouch, Philadelphia, vice-president and counsel; and of the following new directors: Mr. John Gilbert, of Madeira, Hill & Co.; Mr. Wm. A. Webb, president Empire Coal Mining Co.; Dr. T. H. Weisenburg. Mr. Frank Hodson retains the presidency of the company. Mr. P. H. Falter, the new vice-president and treasurer, is a graduate of the engineering department of the University of Michigan, and until recently has been vice-president and general manager of the Canadian Electro Products Co. He had been general manager of the Baltimore Electric Alloys Co., in the manufacture of ferro-silicon and other electric furnace alloys, and for 13 years with the Aluminum Co. of America in various capacities, including design, construction and operation of a number of its plants. Mr. Falter was also general manager of the Shawinigan Electro Metals Co., Montreal, manufacturers of metallic magnesium, and he has also had considerable experience on hydro electric power plant work at Sault Ste. Marie and Shawinigan Falls, Canada.

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One J. & J. Taylor Safe, inside dimensions 15 inches deep, 2 feet 6 inches wide, three feet 11½ inches high and fitted with a built in compartment. Price $250.00.

One J. & J. Taylor Safe 18 inches deep, two feet 9 inches wide, four feet 5 inches high, fitted with a steel compartment. Both safes are in good condition and can be bought at a price that will save considerable money to the purchaser. Price $200.00. Box 900, Canadian Foundryman. 153 University Avenue.

CLOSING TIME

Advertisements for this section must be in our hands on the 9th of each month.

In order that the announcements of your wants, etc., shall not be delayed, please try to have them in our office as early as possible.

CANADIAN FOUNDRYMAN

Good Times Just Ahead

PROSPERITY is within our reach in Canada.

All we need to have and to hold it is a sane, sure grasp on its simple elements.

They are Industry, Integrity, and Faith.

These are the cardinal virtues of human relations. They are the underpinnings of healthy, natural business life and the foundation of a wholesome social system.

They are the fountainhead from which Progress springs. A well-known business economist has called them the "Fundamentals of Prosperity."

Your purchases are an expression of Faith. They are evidence of your Industry. Make them confidently from business institutions of Integrity.

Buying is the backbone of prosperity. An active market means more employment, steadier earnings; benefits are passed around.

Wise spending gives stability to earning and for that reason is far-sighted thrift and sound economy.

The call of to-day is for cheerful thinking, willing working and constructive action by you —everybody—NOW.

To-morrow's change for the better will come about through the combined efforts of each and every one of us.

By sheer force of numbers and co-operation, by the high power of heart and mind, we can put Business on a firm, stable basis.

We can do this because all of the material factors making for better business are right.

Let us link our faith with industry, our vision with courage, and forge ahead.

Let's make an uncommon effort toward a common end—Good Times.

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Directory of Foundry Supply Houses

The Buyers Directory of Canadian Foundryman was originally intended to contain information regarding lines in the production of which the advertisers actually specialized. We now carry the advertising of leading supply houses, some of whom represent scores of manufacturers, in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the supply houses so we recommend that for all general requirements our subscribers communicate with the supply houses listed below:

The Hamilton Facing Mill Co., Limited, Hamilton, Ont.

Frederic B. Stevens, Windsor, Ont.

The E. J. Woodison Company, Limited, Toronto, Ontario; Montreal, Que.

ANODES, BRASS, COPPER, NICKEL AND ZINC
W. W. Wells, Toronto, Ont.

ARGGON
Dominion Oxygen Co., Toronto, Ont.

BRASS FURNACES
Hawley Down Shaft Furnace Co., Easton, Pa.

CHEMISTS
Charles C. Kawin, Chicago, Ill.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Indiana

CORE MACHINES
American Foundry Equipment Co., New York City.

CORE OVENS
Damp Bros., Mfg. Co., Toronto, Ontario.
Monarch Engineering Mfg. Co., Baltimore, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.

CORE PLATES
Damp Bros., Mfg. Co., Toronto, Ont.

CORE SAND
Benson & Patterson, Stamford, Ont.
George F. Pettinos, Philadelphia, Pa.

CRANES
Northern Crane Works, Ltd., Walkerville, Ont.

CRUCIBLES
Joseph Dixon Crucible Co., Jersey City, N. Y.
J. H. Gautier & Co. Jersey City, N. Y.

CUPOLAS
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.

CUPOLA LININGS
Whitehead Bros., Buffalo N. Y.

DUST ARRESTERS
W. W. Sly Mfg. Co., Cleveland, Ohio.

EDUCATIONALISTS
McLain's System Inc., Milwaukee, Wis.

ELECTRIC RIDDLES
Great Western Mfg. Co., Leavenworth, Kansas.
Preston Woodworking Co., Preston, Ont.

FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FIRE BRICK
Bailey & Bell Firebrick Co., Toronto, Ont.

FLASKS, SNAP
American Foundry Equipment Co., New York City.

FLASKS, STEEL
American Foundry Equipment Co., New York City.

FLUXES, IRON, BRASS, ALUMINUM, COPPER
Basic Mineral Co., Pittsburgh, Pa.

GRIT AND SHOT, SAND-BLAST
Pangborn Corp. Hagerstown, Md.

LADLES
Damp Bros., Mfg. Co., Toronto, Ont.

LADLE SHANKS
Damp Bros., Mfg. Co., Toronto, Ont.

MAGNETS
Dings Magnetic Separator Co., Milwaukee, Wis.

FLUOR SPAR
Basic Mineral Co., Pittsburgh, Pa.

FOUNDRY ENGINEERS
Austen Company, Cleveland, Ohio.
Charles C. Kawin, Chicago, Ill.
H. M. Lane Co., Detroit, Mich.
McLain's System Inc., Milwaukee, Wis.

FURNACES, OIL
Hawley Down Draft Furnace, Easton, Pa.
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES, GAS
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES COKE
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES ELECTRIC
Pittsburgh Electric Furnace Corp., Pittsburgh, Pa.
Electric Furnace Co., Salem, Ohio.

GRINDERS, PORTABLE
A. W. Sainsbury, Ltd.
Cleveland Pneumatic Tool Co., Toronto, Ont.

GRINDERS, SWINGING
A.W. Sainsbury Lt., Sheffield, England.

HEATERS
E. J. Woodison & Co., Toronto.

HOSE COUPLINGS
Cleveland Pneumatic Tool Co., Toronto, Ont.

INDUSTRIAL ENGINEERS
H. M. Lane Co., Detroit, Mich.

IRON CEMENT
Smooth-On Mfg. Co., Jersey City, N.J.

KAOLIN
Whitehead Bros., Buffalo N. Y.

MAGNETIC SEPARATORS
Dings Magnetic Separator Co., Milwaukee, Wis.

METALLURGISTS
McLain's System Inc., Milwaukee, Wis.
Charles C. Kawin, Chicago, Ill.

METAL PATTERNS
Bryant Pattern Works, Windsor, Ont.
Hamilton Pattern Wks., Toronto, Ont.

MOLDING MACHINES
American Foundry Equipment Co., New York City.
Benson & Patterson, Stamford, Ont.
Herman Pneumatic Tool Co., Pittsburgh, Pa.
Tabor Mfg. Co., Philadelphia, Pa.

MOLDING SANDS
Whitehead Bros., Buffalo N. Y.
Benson & Patterson, Stamford, Ont.
Geo. F. Pettinos, Philadelphia, Pa.
Venango Sand Co., Franklyn, Pa.

OXYGEN
Dominion Oxygen Co., Toronto, Ont.

PATTERN MAKERS
Bryant Pattern Works, Windsor, Ont.
Hamilton Pattern Wks, Toronto, Ont.

PIG IRON
A. C. Leslie & Co., Ltd., Montreal.
Steel Co., of Canada, Hamilton, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co, Toronto, Ont.

PULLEYS
Dings Magnetic Separator Co., Milwaukee, Wis.

RIDDLES
Great Western Mfg. Co., Leavenworth, Kansas.
The Preston Woodworking Machine Co., Preston, Ont.

SAND
Benson & Patterson, Stamford, Ont.
George F. Pettinos, Philadelphia, Pa.
Venango Sand Co., Franklyn, Pa.
Whitehead Bros., Buffalo N. Y.

SAND CUTTING MACHINES
American Foundry Equipment Co., New York City.
H. L. Wadsworth, Cleveland, Ohio.

SAND MIXERS
Philips & McLaren Co., Pittsburgh, Pa.
National Engineering Co., Chicago, Ill.

SAND SIFTERS
Great Western Mfg. Co., Leavenworth, Kansas.
National Engineering Co., Chicago.
The Preston Woodworking Machine Co., Preston, Ont.

SAND BLAST HELMETS
Pulmosan Safety Equip. Co. Brooklyn.

SAND BLAST MACHINERY
American Foundry Equipment Co., New York City.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.

SAND MULLERS
National Engineering Co., Chicago, Ill.

SAND BLAST ABRASIVES
George F. Pettinos, Philadelphia, Pa.
Globe Iron-Crush & Shot Company, Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND RAMMERS
Cleveland Pneumatic Tool Co., Toronto, Ont.

SHOT AND GRIT, SAND-BLAST
Pangborn Corp. Hagerstown. Md.

SNAP FLASKS
American Foundry Equipment Co. New York City.
Damp Bros., Mfg. Co., Toronto, Ont.
Diamond Clamp & Flask Co., Richmond, Indiana.

SNAP FLASK JACKETS
Damp Bros., Mfg. Co., Toronto, Ont.

STEEL BANDS
Damp Bros., Mfg. Co., Toronto, Ont.

TUMBLING BARRELS
R. MacDougall Co., Galt, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.

VALVES
Cleveland Pneumatic Tool Co., Toronto, Ont.

WELDING AND CUTTING SUPPLIES
Dominion Oxygen Co., Toronto, Ont.

Why Don't You Write?

HARDLY a week passes that Canadian Foundryman does not receive copies of this paper returned by the postal authorities because of the change in firm names or the address of some whose names are on the mailing list. Sometimes complaints reach us of the non-delivery of mail matter. It is not till the receipt of such complaints or the return of the paper, as the case may be, that we obtain any knowledge of the changes or removals of persons or firms. The adoption of the co-operative spirit on your part by notifying changes would make things a good deal more pleasant for both parties. The MacLean Publishing Co. want their mailing list to be in such shape that they will be able to render the perfect service to their subscribers. There is a lot of valuable trade matter mailed by this company and if you don't receive it—well, the fault is entirely yours.

INDEX TO ADVERTISERS

To keep an even balance with the particular, on the one hand and the peculiar, on the other, is something of an art; Stevens' Plumbago (direct from India) is doing just that.

It is suiting the most fastidious.

When you question that, in the least, send for a free working sample and prove my assertion. State the class of molds, whether for cylinders, for flat or raised and indented surfaces like ornamental Stove Plate and your prescription will be filled.

My warehouses are filled with good stocks of Foundry Equipment and Supplies; Electro-Plating Equipment and Supplies for I not only manufacture Foundry Facings, but, also Buffing Compositions and Brass Foundry Supplies.

Canadian shipments made from warehouse at Windsor, Ontario, thus avoiding all bother to the buyer from Custom House details.

STEVENS' STAMPED STEEL LADLES

All sizes in warehouse stock, from 60 lbs. to 250 lbs. capacity, each ladle is stamped from a single piece of steel.

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INDIANA BRANCH:
Hoosier Supply Co.,
138 South Delaware Street
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NEW ENGLAND BRANCH:
Frederic B. Stevens
51 Chestnut Street
New Haven, Conn.
Edward R. Sutton, Mgr.

Manufacturer of Foundry, Electro-Plating and Polishing Supplies and Equipment

Cupola Blocks, Fire Brick and Clay

Corner of Third and Larned Streets
DETROIT, MICH.

Or order from the nearest branch
CANADIAN BRANCH: Windsor, Ont.

PENNSYLVANIA BRANCH:
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CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England.

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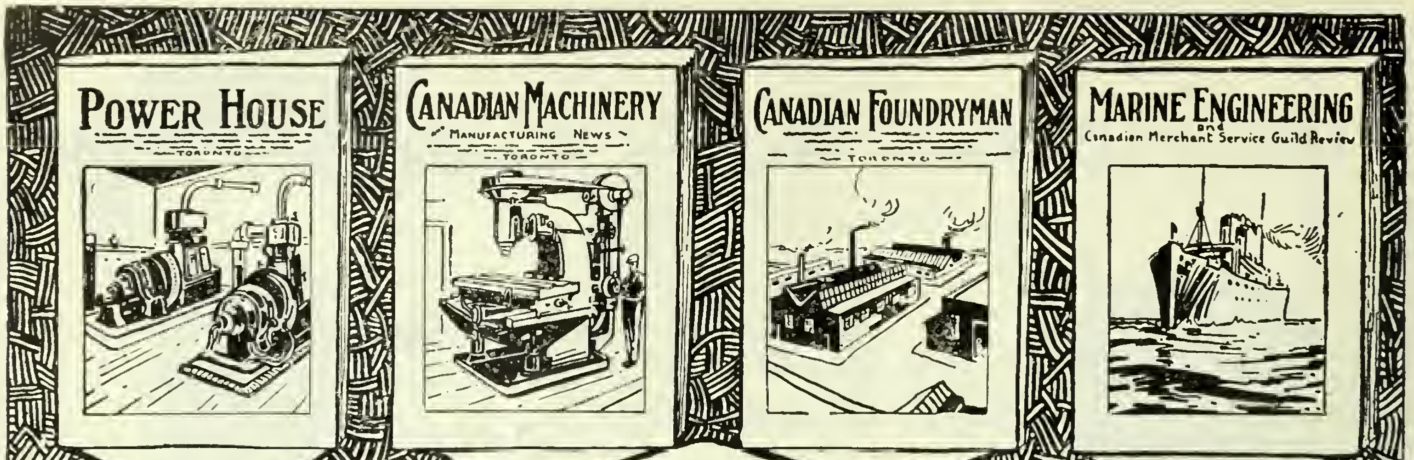
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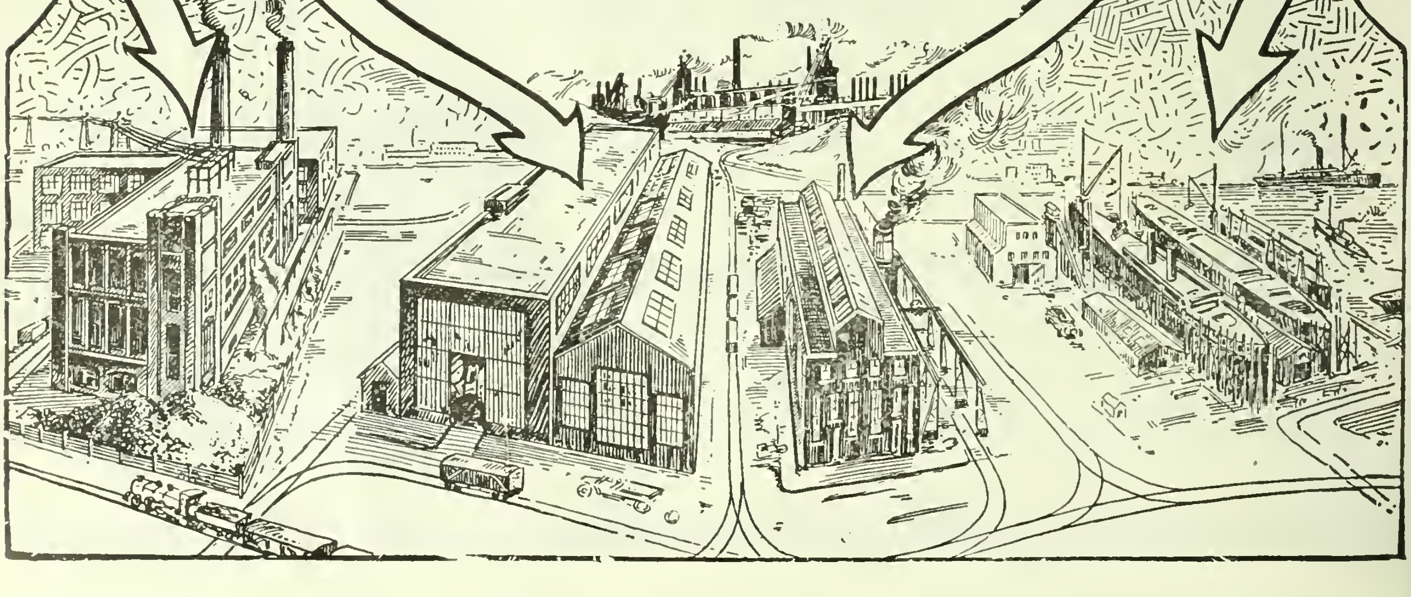
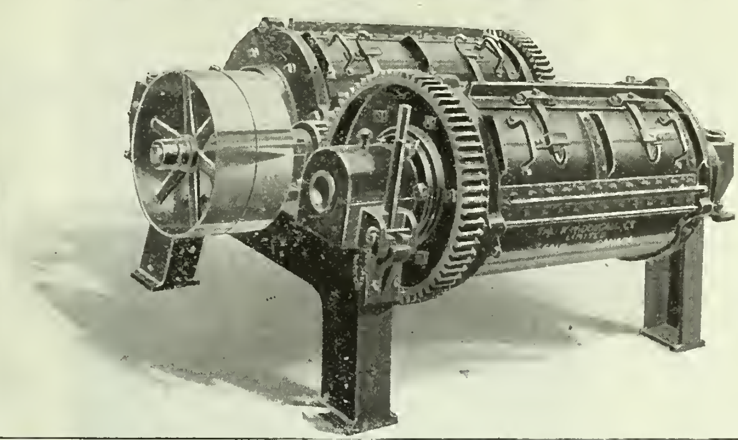
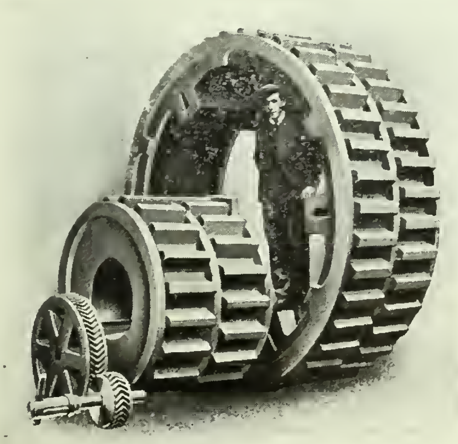






CANADIAN FOUNDRYMAN
AND
METAL INDUSTRY NEWS

Member of the
"Audit Bureau of Circulations"

Established 1909
Published Monthly

Electric Steel Furnace Development in Canada

Proven in 1906 That Canada Ores Can Be Successfully Smelted —Initial Difficulties Ironed Out—Incentive to Production of Certain Alloy Steels—Recognized Part of Modern Steel Plant

By J. Young, Volta Mfg. Co.

THE advent of the first electric steel furnace in Canada might be traced from the time the Canadian Government named a commission to investigate the possibilities of using electric power for the reduction of our native ores. A furnace for this purpose was installed at the Canadian Soo in the year 1906, and the results obtained showed that Canadian ores could be successfully and economically smelted. Dr. Heroult and R. Turnbull were the designers of this furnace, and, immediately after completing this initial test for the Canadian Government, they designed and installed the first of the famous Heroult type electric steel furnaces—this first furnace being built and used in the States.

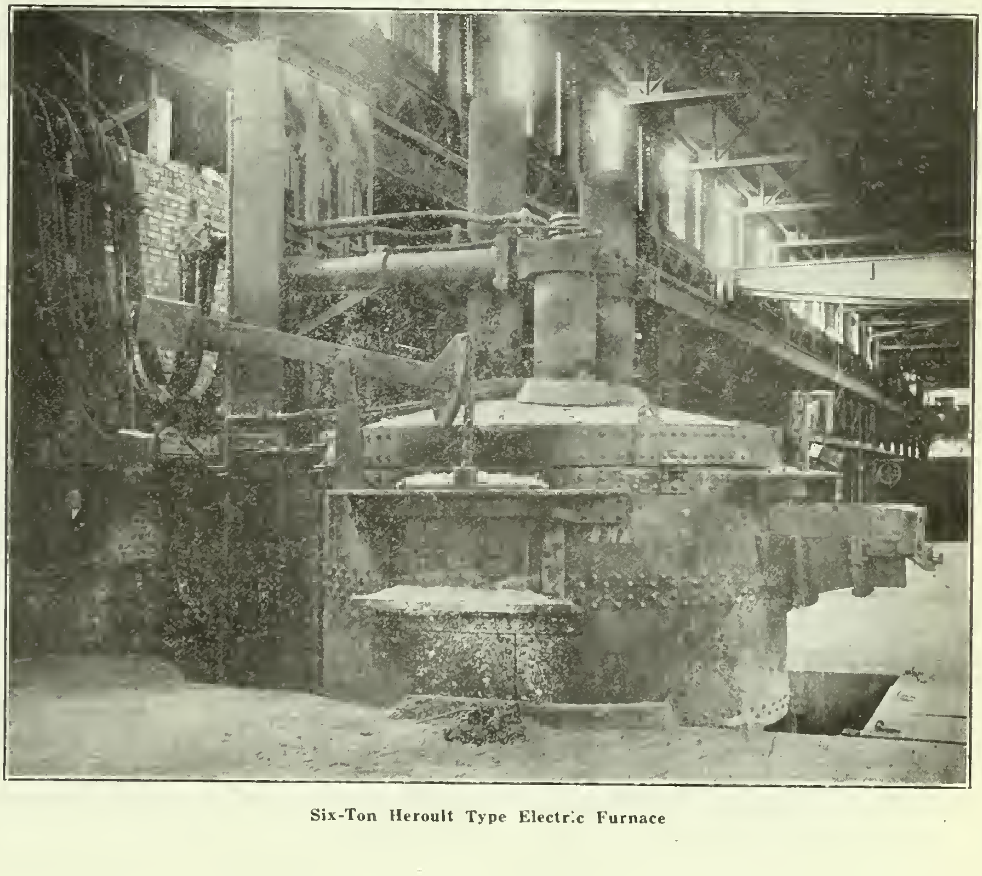
Early Difficulties

In the first furnaces built the designers were faced with many serious difficulties and had to be possessed with an abundance of courage and perseverance. Owing to the high temperatures at which electric steel furnaces operate, much of the standard equipment, at that time, was not suitable; refractories, which would stand up any length of time, were difficult to get, while the standard electrical insulations, used on furnaces at that time, were continually breaking down on account of the heat; mechanical parts, of standard design, were found unsuitable to stand the conditions peculiar to electric furnaces. Then, there were the electrodes to contend with. Electrodes of only a small size were made at that time, and a good deal of experimenting and research work had to be done before electrodes, that would stand up a reasonable length of time, could be obtained.

These initial difficulties, however, were gradually ironed out and the electric steel furnace then began to assert itself. The steel men became interested in it for several reasons. It had been proven, conclusively, that electric steel had properties which could not be got by the other methods of making steel; it could be produced economically, and it presented the only means of making the special alloy steels which were necessary in the automobile industry, with the result that installations began to appear in various parts of the country and these furnaces were giving highly satisfactory results when the war broke out and an added impulse was then given to their use. Canadian Steel Companies, whose limited market up to that time caused them to hold back, then began to instal electric furnaces with the result that by the year 1919 there were at least 40 electric steel furnaces in operation in Canada, capable of producing over 200 000 tons of steel per year. The British Forgings, Limited, of Toronto, Ont., had in operation a battery of ten 6-ton capacity Heroult type furnaces, which was, at that time, considered the largest installation of electric steel furnaces in the world. Since the termination of the war the number of electric furnace installations have been continually added to with the result that there are, as far as the writer's knowledge goes, approximately 50 furnaces installed in Canada at the present time.

Causes of Failure

As I have previously stated, the electric furnace, in the steel industry, is now a recognized part of a modern steel plant. There are, however, instances where the electric furnace has not been a success. These failures can, in many cases, be traced to an over-zealous salesman, who in his ambition to make a sale, has not taken into full consideration the local conditions, or, again, it may be due to poor operation. The electric furnace cannot be operated, to give the best results, with any sort of mediocre operation—in fact, as in all other businesses, a man thoroughly acquainted with his work will give better service than the one who lacks experience. I heard the



Six-Ton Heroult Type Electric Furnace

statement made that it just cost a certain party $10,000 to find out that electrical steel castings were not sound and could not be depended upon. To those conversant with electric steel furnaces such a statement would not be taken seriously, as it has been amply proven that electric steel castings are superior to either open hearth or converter castings. On the other hand, such statements tend to check bona fide sales.

I stated that during the war the electric steel furnaces established their place in the steel industry. In one forging plant, where a complete record was kept of the different steels used for shells, and where the blanks came from diversified sources, those made by the electric process showed less rejects and superior physical qualities in every way as well as more consistent chemical analysis. I do not mean to say that the electric furnace will take the place of other methods of making steel. It has its place as a steel producer, and, where installed with proper judgment and operated by efficient men, will give satisfactory and highly efficient service.

Of late, manufacturers of grey iron castings have turned their attention to the use of the electric furnace for making grey iron in order to meet the ever-increasing demands for high quality grey iron castings, and several furnaces have been installed to produce grey iron for the making of cylinders, piston rings, etc., used extensively in the automobile business.

In Canada, however, where electric power is comparatively cheap in many localities, the electric furnace not only is a competitor with the cupola on a quality basis but also on a cost basis for ordinary castings and furnaces are in operation in Canada, producing electric grey iron for castings, continuously.

The electric furnace differs from the cupola in this respect, that it offers a larger range of products on account of the fact that the analysis of the finished article can be controlled within a very fine degree. Furthermore, a dual system is in use in some places—and is working out successfully—where steel and grey iron is produced from the same furnace.

Electric Furnaces for Many Industrial Purposes

Great Flexibility Indicated—Efficient and Economical—Makes for Better Working Conditions in Baking, Hardening, Enameling, Heat-Treating, Annealing, Melting and Forging—Application in Soldering, Heating Auto Rims, and Drying Lumber

GREAT is the variety of industrial utilities to which electricity is being applied. This has interesting illustration in the development of heat-treating furnaces for many different purposes. The scope of this field demonstrates the flexibility of electricity, and results actually obtained establish its merits as being economical in every department. It eliminates laborious operations and hence serves to reduce cost; it has been the means of saving valuable floor space by confining certain operations to smaller areas; in the matter of cleanliness, where such is an absolute necessity, it is beyond comparison with gas or oil; there are no offensive odors or excessive outside heat, and its efficiency has been established as beyond question. When it has been given a fair trial and wherever engineering skill has had an opportunity to adapt it to local conditions or particular purposes, results have been satisfactory and electricity has won favor as a desirable heat-treating medium. Safety insulations and switches have been developed and designed whereby danger from high voltages has been reduced to a minimum and at the same time recording and indicating apparatus constructed whereby the power may be adjusted to the operation, automatic or otherwise, with absolute precision.

Illustrations courtesy R. H. Cunningham & Co., industrial furnace engineers, London, Ont.

Scope of Heating Operations

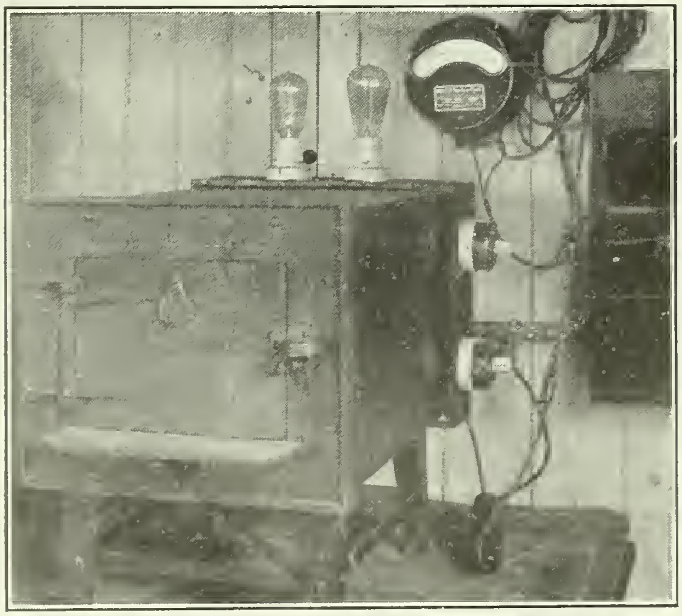
The statement is made by an experienced electric-furnace engineer that electricity can be used for any heating operation requiring temperatures from 100 to 2,600 degrees Fahr., and for metal melting from 100 to 4,000 degrees Fahr. successfully and efficiently. Here are a few of the applications in Canada of the electric furnace to purposes that may be considered more or less exceptional:—

Baking 10,000 headache tablets per hour.

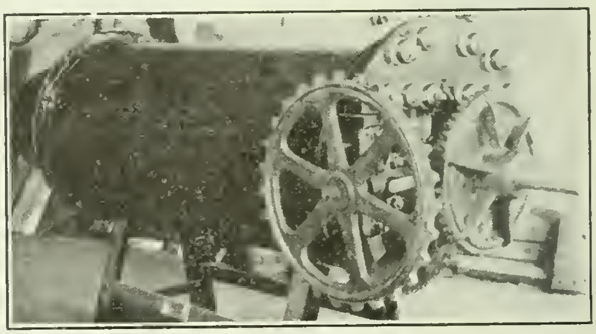
Baking corn flakes at the rate of 500 lbs. per hour.

Heating 120 auto rims per hour for shrinking on felloes, and also for drying truck bodies.

Electric lead pot, 12 ft. long by 2 ft. wide heating 30 No. 10 iron wires to



Electric furnace used by manufacturing jeweler in enameling name plates, society pins, etc., and also for hardening dies and tools.



Automatic electric furnace for heat-treating small parts. These are fed in at one end, carried through by worm, and released at other end.

1,550 degrees Fahr. traveling at the rate of 100 feet per minute.

Tinning 30 No. 22 iron wires traveling at the rate of 320 feet per minute.

Porcelain enameling 60 bath tubs per day, and 50 auto name plates pere hour.

Hardening 30 planer knives, 2½ in. x ½ in. x 33 in. per hour at 2,350 Fahr.

As to the industrial scope of the electric oven or furnace the following outline is elucidating:—

Drying.—Varnish, lumber, paper, moulds, plastic forms.

Baking.—Bread, cereals, enamels, cores, transformers, motor windings.

Coloring.—Nails, wire, wire cloth, stampings and metal parts.

Annealing. — Wire, tools, machine parts, brass stampings, silverware, white metal stampings, castings and other metal parts.

Hardening.—Steel tools, bearings, wire, springs, drills, both high speed and carbon, reamers, milling cutters, lathe tools, taps, dies, saws, knives, etc.

Preheating.—All types of high-speed tools.

Porcelain enameling.—Bath tubs, kitchenware, stove parts, signs, lodge and fraternity pins, etc.

Heating.—Automobile rims for shrinking on felloes.

Burning.—Carbon electrodes, manufacture of graphite, china, porcelain and clay products, bank notes, pari-mutual tickets, general incineration and cremation.

Metal coating.—Tinning or galvanizing wire and other metal products.

Melting.—Solder, lead, soft metal alloys, zinc, tin, brass, copper, bronze, iron, steel nickel, chromium, vanadium, tungsten and other alloys.

Forging.—Steel and tungsten.

Miscellaneous.—Soldering iron heaters, hot plates, plating and cleaning baths, water stills; laboratory furnaces and dental furnaces.

Application to Soldering

Electric soldering furnaces are among the most recent and useful applications. Here, again it has been demonstrated by actual test that the cost is less than gas. Records in one case show an hourly consumption of 840 watts. To bring the furnace up to a required temperature of 1,200 degrees Fahr., takes from ½ to ¾ of an hour, and a pair of 1½ inch coppers may be heated as desired in three minutes. The dressing and cleaning of coppers is no small item in extensive soldering operations, and with electricity it may be done in one half the time consumed where gas is used. Then, again, working conditions are greatly improved for there is no objectionable heat, and obnoxious fumes are eliminated. While the difference in operation costs, so far as actual consumption of electricity and gas is concerned, is slightly in favor of the former, other conditions give it a decided advantage.

An outstanding instance of economy has to do with the use of electricity for drying purposes in lumber mills, when they happen to be within a hydro zone. At night, while the mill is inactive, the available power may be used, say at 1/6 of a cent per kilowatt, in connection with the drying kilns, thus converting chargeable load to useful purposes and eliminating fuel costs otherwise necessary.

Electricity, it is found, has also its advantages in heat-treating dies and punches, as not only being economical but much cleaner than old methods. The product is practically free from scale of any kind and this is most desirable. Many large tool rooms are adopting the idea.

HEAT TREATING NOT ANNEALING

Heat treating is a subject which is quoted frequently in technical articles but understood by few practical men. It is usually passed over as being something in connection with steel for special purposes. This is far from the proper definition as heat treating is used to first class advantage on common cast iron. To be sure heat treating is a form of annealing but it is not usually done for that purpose. Heat treating is more for the purpose of relieving uneven strains such as will develop in a casting of uneven thickness, on account of the lighter section cooling before the heavier part. If the casting can be heated to a sufficient temperature to allow the particles of the metal to become relieved and then cooled slowly the heavy and light parts will cool together and cause all stress to be equal.

Grey iron castings very seldom receive heat treatment of any kind, being used just as they leave the mould. The benefits resulting from proper heat treatment are many. Take, for example, a lathe bed casting. Some engineering firms rough machine such castings, then leave them out in the weather for several months for "seasoning." The reason given for this is that "if a lathe bed casting is machined and finished without seasoning, it twists and goes out of shape, and the lathe is no longer accurate." Why? In a lathe bed or similar casting, where unequal thicknesses of metal are joined together, internal stresses are set up by the contraction at different times of the various thicknesses of metal, assisted to an extent bv the cores. When the skin of the casting is broken these stresses begin to assert themselves, and in time pull the casting out of shape, and no period of sun and weather will ever completely take these stresses out. Heat treatment will.

Castings of unequal thickness of metal, where accuracy in the finished machine is desired, should be heated slowly to approximately one thousand degrees Fahr. and held at this temperature for at least twelve hours and then allowed to cool slowly in the furnace.

This will give a casting which will not keep its shape, but possess the maximum strength in all parts. Hard spots in medium castings and all hard light castings are very often the result of chill from water. When these faults are found the results from the machine shop are far from satisfactory, broken drills and reject castings being numerous. To stop this the castings ought to be heated to 1,500 deg. Fahr., held at that temperature for two hours, and then allowed to cool slowly in the furnace. For both of these heating operations muffles or steel boxes, securely luted with fire clay to prevent oxidation, should be used. Not only so, but the castings should be painted over with powdered charcoal or coke and water.

PORTLAND CEMENT SAVES FIRE RISK

The Portland Cement Association of the United States has the following to say, which while intended as a boost for their business, is really worth knowing:

Fire losses in the United States in 1921 were more than half a billion dollars.

Fire loss adjustments made by insurance companies in the United States and Canada during the past fourteen years amounted to $3,410,752,600. The average yearly loss was $243,625,200. The loss for 1920 was $330,853,925.

Losses from fire in the United States average $3 per capita per year. France has a per capita loss of 49 cents; Great Britain, 33 cents; Germany, 28 cents, and Holland, 11 cents.

During the past fourteen-year period our fire losses were 28.1 per cent. of the value of new building construction. In 1920, although an abnormal amount of building was done, the fire losses were 23.5 per cent. of the value of new buildings.

Startling as these losses are, they do not tell the whole story. They represent only the actual insurance adjustments made. They do not take into account losses due to the fact that buildings are seldom insured for more than 80 per cent. of their full value, nor do they include losses not covered by insurance. The insurance adjustments made probably do not exceed 70 per cent. of actual fire losses, including both insured and uninsured.

The surest safeguard against loss by fire is a building so constructed it cannot burn.

Reinforced concrete represents the highest type of fire-resistive construction. Concrete is practically maintenance free. Concrete grows stronger as it grows older.

CONFIDENCE

It is the determination to do and dare that makes for success. It is your God-given right to have all of the happiness that success can bring to you. Cultivate confidence in yourself so that you may have the nerve and initiative to reach out and help yourself when the horn of plenty is offered to you. Do not procrastinate! "Time and tide wait for no man."

Utilizing Heat of the Cupola to Warm the Blast

By Having Cast Iron Air Jacket Above the Melting Zone the Air is Heated From the Waste Heat of the Fuel, Before Passing Into Fire

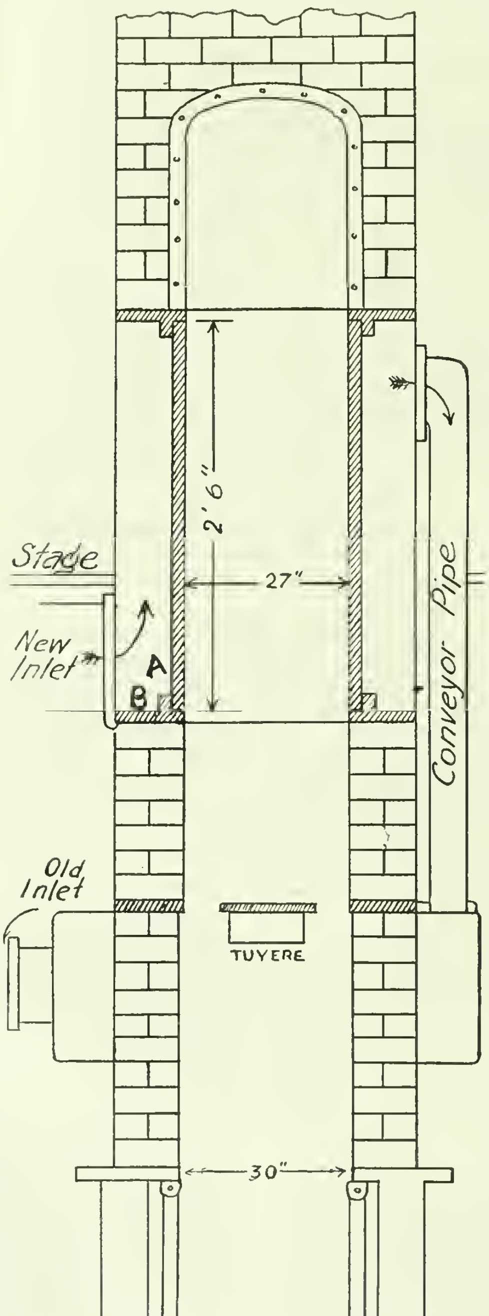
IN THE sketch Fig. 1, is a hot blast cupola invented by Mr. James Higham of Owen Sound. Mr. Higham is a foundry superintendent in that city, and while his original experiments were carried on in England, he has just recently perfected his furnace so that he knows it is a success, as he has one in use in the foundry where he is employed.

Some time ago a description of a small one of his own make appeared in this paper. In Fig. 2 will be seen a photograph of it as it appeared at the time, but since then a full-sized cupola has been tried out with perfect satisfaction.

A few points on melting will not come amiss before describing this cupola. To melt iron requires some 2,300 degrees of heat. This terrific heat must be concentrated in one place known as the melting zone, which is usually a couple of feet above the tuyeres where the blast enters. This zone only includes a very few inches, so that a foot above it is never at a sufficiently high temperature to melt iron. At the melting zone the walls must be lined with some refractory material such as fire brick which will resist this incandescent heat. Above this a cast iron lining is as good as anything else. Blocks of iron shaped like fire bricks have frequently been used for this purpose with better success than could be had from regular fire bricks, as the iron was not affected by the abrasive action of the fuel and metal being charged into the cupola.

In the sketch here shown, the cupola is lined above the melting zone with a smooth iron pipe, which is even better to resist the rough usage to which a cupola lining is subjected than the blocks would be and is, furthermore, essential in order to furnish the hot air chamber necessary to create the hot blast. Hot blast has been tried on different occasions with doubtful success and condemned on the same grounds that David McLain refers to when he speaks of certain foundry men who have tried to make semi-steel without knowing how and failed to get satisfactory results. This type of man condemns the McLain system or any other system which touches on a subject which was a failure in the hands of unskilled workmen. So it is with the hot air furnace for melting. Some experimenters have been unsuccessful but not all of them.

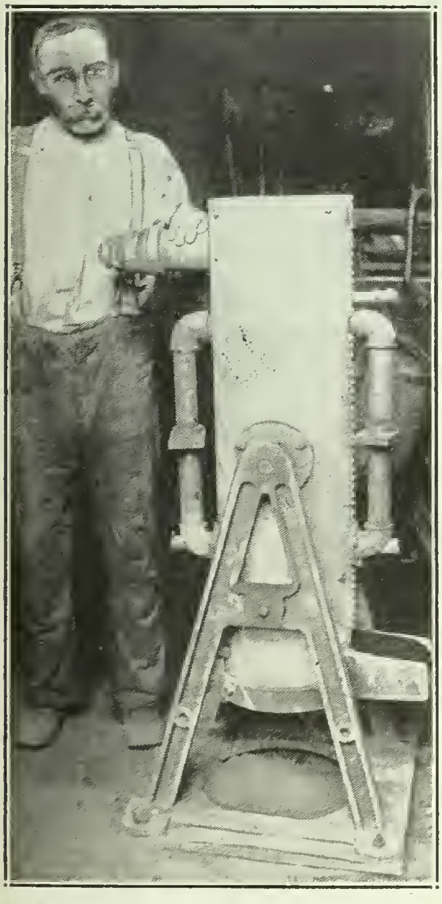
While the temperature above the melting zone is not sufficiently high to melt iron, it is nevertheless high enough to make it red hot. If this red hot tube is exposed to a continuous heat it will continue to absorb it and throw it off from the outer surface. If this outer surface is encased in a steel shell and the intervening space kept constantly filled with cold air, this cold air will absorb the heat which radiates through the cast tube. Of course the air does not remain there long enough to absorb very much heat, and this will be the argument advanced by those who do not want to believe in it. If they will take a few lessons from the hot blast furnace which is used in making pig iron, they will see things differently. All the heat which is used to raise the temperature of the blast at the pig iron works is generated at the furnace which is going to receive the blast. Not only this, but more heat than can be used is generated; the surplus heat being utilized for other purposes. To this I might add that in a modern blast furnace the air is frozen before it enters the heating chamber.



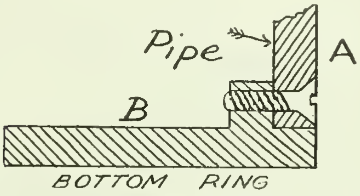
Hot blast cupola in use at Owen Sound foundry, giving best of results.

In the pig iron blast furnace, layer upon layer of coke and iron are charged on continuously, but only the bottom one is under proper combustion, while those above it are being heated and gas produced thereby. This gas is not allowed to escape through the stack, but is conveyed down through a pipe to large tanks which are known as stoves where it is burned. The pipe which conveys the cold blast from the blowers has to pass right through these stoves on its way to the furnace and this is all the heat which the blast receives to entitle it to be called hot blast. As I started to explain, the cold air from the blower before passing through the stoves has, in some instances, to pass through an ammonia refrigerator which removes all the moisture from the air by freezing it. The air does not dwell in the refrigerator in order to allow the ammonia to do its work, but it enters one side and passes right out of the other and the ammonia has to do what it is going to do while the air is passing through. When this air which is at a temperature below the freezing point enters the stove it does not wait there to be heated, but it must absorb what heat it can on its way through. Yet as I have already said there is nothing in the stove to heat it excepting the gas which was created in the very furnace to which the heated air is bound. This gas had to do a lot of round about work before it was in a position to be used and then it had to heat very cold air.

With the cupola here shown, the gas does not have to be carried about, but burns direct, and as Mr. Higham is prepared to prove by demonstration, it does the work and shows results. In the original furnace as shown in Fig. 2, the blast entered at the upper part of the chamber and was discharged at the lower part. This saved a long stretch of pipe from the top to the bottom of the chamber. In Fig. 1, it will be seen that this has been changed so that the blast enters at the bottom of the chamber and is discharged from the top. By this means the cold blast on entering, beats against the bottom portion of the red hot tube, preventing it from becoming too hot, and at the same time, working in harmony with the laws of nature, the hottest air goes to the top from where it passes out and is forced down the pipe which leads to the air belt which was on the shell before the alterations were made. It might be explained that the one shown in Fig 1, is the cupola which was in use in the foundry, and the hot air arrangement was attached without trouble. The wind pipe from the blower was not molested except to remove the portion which came down to the jacket. The old inlet was closed up and a new one made on the top of the jacket on the opposite side. All the new material was made in advance, while the cupola was running old style. When the brick-lining became so badly burned that it required to be relined, the old bricks were torn out, and before putting in the new ones the hot air arrangement was introduced. The opening in the foundation plate as is shown in the illustration Fig. 1, was thirty inches, so the iron tube was made twenty-nine inches in diameter on the outside which allowed half an inch clearance all round. Loose flanges were made for top and bottom. These were made in sections, as complete flanges of necessary size would not go through the opening in the plate. Before putting on any of the brick lining, the tube was pulled up through the bottom plate and part way into the stack. The brick work was then built up to proper height and the bottom flange bedded onto it, after which the tube was lowered down onto this flange and the top flange put in place and the brick work continued up into the stack. The wind pipe from the blower, as can be seen in the illustration, connects at the bottom of the heat chamber after running along under the staging as it always did. Since overhauling the cupola and making these changes, it runs along as before, but with a considerable saving in fuel and producing cleaner castings. Those who doubt the truth of this statement should remember that with the ordinary cupola the melted iron has to pass through the belt of cold wind after leaving the melting zone, before it reaches the spout. The melting is done about two feet above the tuyeres, but right at the tuyeres there is a sheet of cold air which must go to the center of the cupola if anything like perfect combustion is to take place. Everything in line with the sheet of air and below it is cold and black. A look through the tuyeres will show nothing but black coke; below this it is colder than in the ladle and the idea of holding iron in the cupola until enough has been melted to pour a large piece has long ago been proved to be a fake. It would stay hotter in the ladle. This is only one point in favor of hot blast. However, "the proof of the pudding is in the eating it" and Mr. Higham has proved to his satisfaction that hot blast cupola is a success. In Fig. 3 will be seen section of bottom plate of tube with bolt to hold them firm. With the plate in sections and the weight of the tube bearing down on it, there is a risk of the sections sagging on the inner side. By fastening them together this is prevented.



Miniature hot-blast cupola used for experimental purposes.



Showing method of securing shell to avoid undue weight on edge of wall.

EFFICIENT ANNEALING OF MALLEABLE CASTINGS

In reply to a question recently appearing in the transactions of the American Society for Steel Treating, on "What is the shortest time in which malleable castings can be annealed to produce the best malleable qualities?" H. A. Schwartz, manager of research, National Malleable Castings Co., Cleveland, gives the following:—

A strictly correct reply would probably be infinity since, speaking broadly, every means of accelerating graphitization is detrimental to the ductility of the product. A strictly logical conclusion thus would indicate that the slower the process the better the product, hence the best product can be made only in infinite time. Graphitization proceeds more rapidly and less completely the higher the temperature. Its commercial execution is accomplished by holding the metal for a time at a temperature well above A_1, and then cooling in such a manner that the metal shall be at or near A_1 for a sufficient time to complete the reaction.

Time will be saved by executing the preliminary treatment at the highest practical temperature. However, the higher temperature the coarser the temper carbon granules and the less strength and ductility, consequently there is a limit to the time to be saved by raising the initial temperature. Commercial opinion varies as to the highest safe temperature. Some manufacturers feel it unsafe to go above 1 500 degrees Fahr.; others go as high as 1 850 degrees Fahr. The former makes for quality, the latter for speed. A temperature of 1,600 or 1,625 degrees Fahr. is perhaps a conservative middle course.

Commercial practice varies with respect to the completion of the reaction. Some metallurgists cool slowly through the critical range; others feel it better to maintain a constant temperature just below A_1 for some time. The latter course, no doubt, saves time but requires very accurate control to avoid passing above A_1 by accident. Graphitization can be accelerated by an increase in carbon or silicon, both of which deteriorate the quality of the metal when present in too large an amount. Here again speed is had at a sacrifice of quality.

In the early days, using carbon and silicon in amounts now considered excessive, it was very common to occupy 7 days for the annealing cycle. The recent improvements in malleable castings were accomplished in part by reductions in carbon and occasionally silicon and by greater annealing precautions. The time for annealing has thus risen for two reasons. The writer has frequently annealed metal in small commercial furnaces in 3½ to 4 days. The metal was never of superior quality and frequently very unsatisfactory and this attempt to hasten deliveries was definitely abandoned.

The design of heating furnace also affects the answer since uniform rapid heating is difficult to attain in large furnaces; but such furnaces are economical of fuel and space. Under commercial conditions and on an operating scale, the writer would regard with suspicion metal annealed in less than 7 days and would not regard 10 or 11 days as excessive. Where particular importance is attached to ductility and to machine-ability, without sacrifice of strength, still longer times may be called for. A single piece, of inferior quality, could no doubt be produced experimentally in around 50 or 60 hours.

The Casting of Pipe Specials In Green Sand

Simple Appliances for Getting Job Done Quickly by the Use of Strickle—Core is Swept Up in Green Sand and Used as Pattern.

By MAJOR JOHNSTON-TAYLOR, Shrewsbury, England

IT often happens that on an out of the way job a special pipe is required urgently, more often than not to replace one broken in transit or otherwise damaged. This usually means sending to the pipe founders for it, which in turn means delay which might possibly be serious.

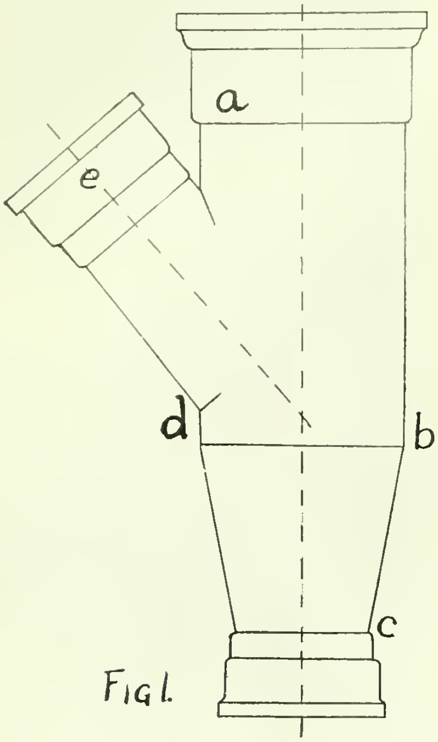


Fig 1.

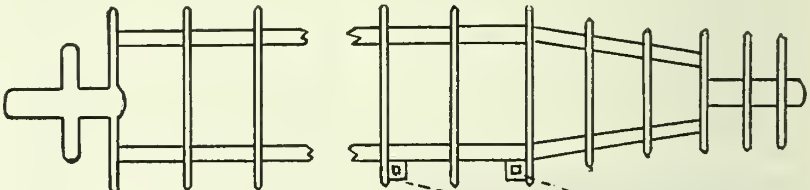
The following methods have been found suitable for casting specials in green sand, and enable the job to be undertaken by any intelligent founder, who may ordinarily be just in the jobbing line, but near at hand and able to push the job through.

The first thing to do is to cast the core iron, and then dig a hole in the floor approximately the size of the casting, in this case assumed to be the branch pipe shown in Fig. 1. This hole is left six inches deeper than the size of the casting and eight inches wider on each side to give room for ramming behind the pattern. The moulder then rams the bottom firmly and throws in a little sifted black sand and in turn some facing sand at the end of the pipe marked a. For that portion of the mould which has no pattern a spirit level square and strickle are employed. Plenty of facing sand must be used in the intervals between the patterns, because the moulder has to strickle out the thickness of his pipe after the core has been drawn out.

The portion from b to c is made in a similar manner, except, in the case in point, a smaller socket would be used for the other end. The template board x is placed against the line a-d to form the angle, the socket for e is placed against the template and the bottom part of the mould for the branch pipe would be made in a similar way to the other parts. When this is complete, a heavy (about 56 lb.) weight is sunk in behind the flange of each socket at a distance of 6 or 8 inches.

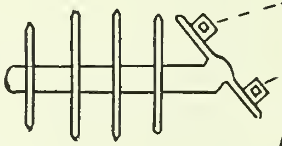
These weights when properly bedded down form a firm rest for the core iron, the latter being constructed by means of an iron wing and the two pieces of wood pattern shown in Fig. 6. The core iron is then lowered into the mould and the bars, which would be about half an inch from the pattern, are packed with facing sand.

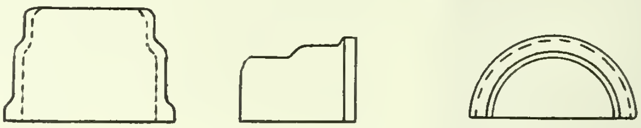
The core iron for the branch pipe is made separate as shown in Fig. 3, and is bolted on to the main core iron, the bolt holes being shown. Ramming can then be proceeded with till the joint level is reached, when the core should be flat rammed between the bars and well vented. A layer of coke is then heaped up to within a few inches of the radius and covered with sand. The top halves of the socket pattern are now placed over the bottom halves, and the ramming up of the top portion done in a similar way to the bottom half. It is rammed up in the ordinary way with bars, gridiron, hooks, etc., and after having lifted the top off the core is got out and strickled to the required thickness, blacked, and returned to its place in the bottom after the latter has been finished off. The runners are cut in the bottom and run down through the core print from the top. The remainder of the job would be done in the usual manner, the top being heavily weighted to prevent lifting. Specials of the class shown in Fig.



Main Core Iron.

Fig 2


Branch Core Iron Fig 3


Socket Patterns (Iron) Fig 4

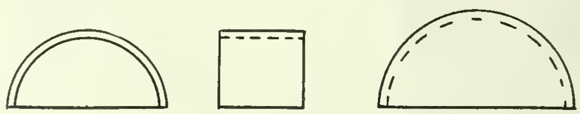

Straight end Patterns

Fig 5

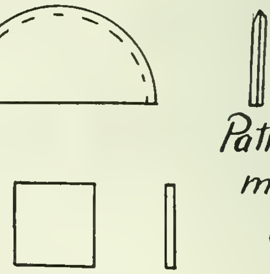

Patterns to make Iron Core

Fig 6

1 have been successfully made by this method up to six and one half feet long and 24 inches in the larger bore.

BENCH GRINDER

In the construction of bench grinders it generally is necessary to incorporate a motor approximately as large in diameter as the grinding wheels to obtain the desired operating power. Such a motor sometimes interferes with the grinding operation, especially in handling work that must be fed past the wheel, or in grinding various types of tools. This difficulty has been overcome in the grinder shown in the accompanying illustration. It is equipped with a squirrel-cage, induction motor with the windings at the rear only,

Forbes bench grinder.

which leaves ample space between the two grinding wheels for the easy manipulation of the work.

The machine accommodates 6-inch wheels which project 1¼-inch beyond the motor casing. Thus it is possible to utilize three-fourths of the material in the wheels before they are worn to a level with the motor. The design also makes it possible to grind on both sides of the wheel. The grinding wheels are protected by ample guards, while the tool rests are flat steel, adjustable in two directions. The spindle is ¾ in. in diameter, operating in ball bearings. The wheel flanges are of large size, while the motor and bearings are enclosed. The motor develops ½-horsepower at 3 600 revolutions per minute operating on two, on three-phase, 60-cycle current for 110, 220, 440 and 500 volts. The grinder is made by Forbes & Myers, Worcester, Mass.

OPPORTUNITY

It has been said that "Opportunity knocks once at every man's door." It is a mistake! Opportunity knocks frequently for every man, but some people persist in wearing ear flaps so that they will not hear the call to success and prosperity.

Opportunity might be likened to an alarm clock. If you answer the call when it comes, you will recognize succeeding calls. But if you turn over on your side and close your eyes, the time will come when the call will no longer disturb your slumbers. You will be a dreamer, and your God-given-right to success and prosperity will slumber and snore with you. Assert your rights to your natural inheritance! Wake up to your opportunities! Be a doer and not a dreamer.—Smallwood.

Difficult Pattern Problem

By D. A. Hampson

Machine shops come in contact with architects but little, and vice versa, though occasionally a blue print from the building profession does find its way into our realm. It was in connection with the new bank building in town that we once more encountered an architect's design, this time as a request for a price on the part shown by Fig. 1.

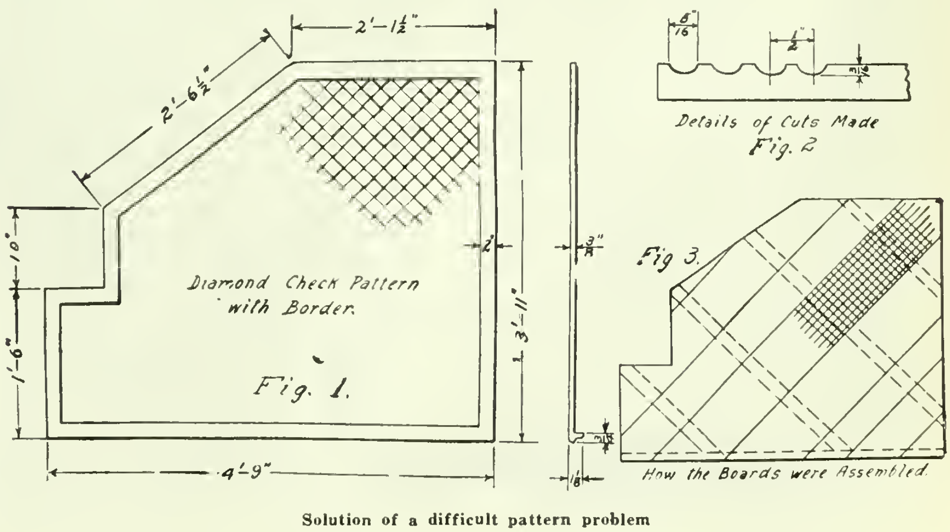
An examination of the drawing shows that it requires a pattern less than half an inch thick and roughly 47 in. x 57 in. Also that this area is covered with a series of diagonal grooves as shown at Fig. 2—over two hundred and fifty in all—which end in a plain border all around. Everyone familiar with the mechanical trades will say at once that such a design is ridiculous—that two pieces of steel corrugated floor plate could be welded together at a fraction of the cost of the pattern alone and be a better job, that the cost of making one such pattern for one casting is entirely out of proportion.

We knew all of this, and the more we studied the drawing the less we felt inclined to quote on the job. Those who have had experience with diagonal grooving jobs will agree with us that such work is the most deceiving of all the simple jobs that crop up, both as to speed and cost and to accuracy. To set a saw gauge at an angle, pass your boards over the saw, and expect your cuts to come out evenly spaced and parallel is a seeming impossibility. Even if you have a series of holes or slots for spacing and have the assistance of a second person to help keep the boards in place and to support these exasperatingly long overhanging ends, you have the same trouble.

In this case, we called up the builder and told him frankly that no engineer planned that piece, that it would cost the best part of fifty dollars to get out the pattern, and that we didn't want the job. He countered by saying that it would take too long to correspond with the architect in New York and for us to go ahead and make the piece as cheaply as possible. Well, when a disagreeable job is forced on you, you usually get it out of the way as soon as possible—and that's what happened to this stair casting.

The solution was so simple that it is ridiculous, yet in half a dozen cases of this kind, no one has thought of that way out. Fig. 3 shows how it is done. We had a grooving tool of the desired radius and, aside from that nothing but the cut-off and ripping gauges on the saw were used. One man did the work alone. A sufficient number of ⅜ in. boards were gotten out and jointed carefully on the edges. Then each board in turn was placed against the cut-off gauge and grooved across the grain, spacing by means of a latch dropped into a notched bar which was part of our regular pattern shop equipment. Next the boards were grooved lengthwise. This gave us the diamond check pattern required, but at an angle of 45 degrees to the outsides of the piece as detailed, which was easily remedied by the "solution" by cutting off the edges of the boards to the same angle.

Referring to Fig. 3, it will be seen that the diamond effect is obtainable this way and that by placing battens, as indicated by dotted lines, the assembly was made reasonably secure. The molding rib along one edge, also helped to stiffen. Thus a fairly good pattern was made up for about half what we thought possible. The boards were grooved clear to the ends and the plain border was obtained in the foundry by the molders measuring off a two-inch strip and sweeping away the impression of the grooves from there to the edges. The casting came out well and we felt that we had contributed much toward making "a go" of a poor design.



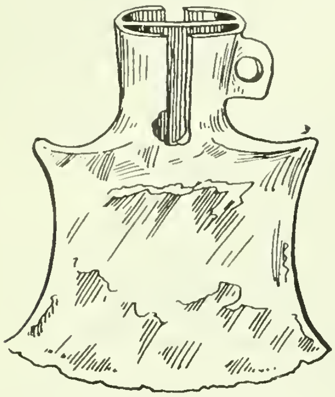
Solution of a difficult pattern problem

Development of the Metals After the Stone Age

Improvements Came Slow But Sure. Thousands of Years Required to Perfect the Axe From the Stone Wedge of the Ancients, to the Steel Axe of To-day

By F. H. BELL

IN OUR last story of ancient bronze axes we showed an Irish specimen which was in many respects similar to the modern axe, but intended for an L shaped handle to be fitted into a perfectly round opening at the top. The handle being round and fitted in a round opening would allow the axe to turn. The small eye at the front which allowed of a strap to hold the axe onto the handle and would to some extent prevent turning but not in a



very satisfactory manner. Had the opening been oval it would have enabled a handle to be securely attached to the axe, but it apparently did not enter anyone's mind to do this.

In the first illustration here shown is the scheme arrived at to keep the handle in place. The axe is one of many specimens of the same type found in different Asiatic countries and likely represented the latest thing in axes all over the civilized world at the time. The man who invented this probably thought that he had gone the limit which would never be surpassed. Here was the round ferrule on the top with a bridge wall through it to prevent the handle from turning and a staple in the front to tie the handle so that it could not come out. The slots in either side might have been for additional security against turning. If the handle was also fitted to these it would certainly be secure. It is hard to understand why people would go to all of that trouble when with much less trouble they could make one similar to the axe found on the island of Cyprus which has an eye the same as the present day axe but with all the other characteristics of a real old timer.

CYPRUS

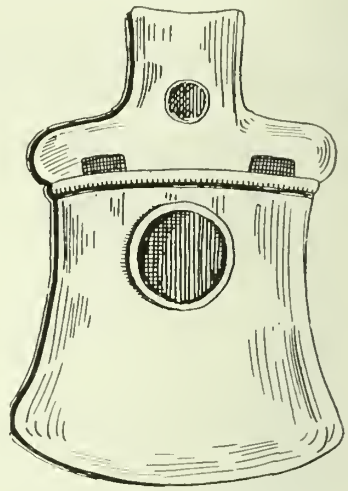
Cyprus was one of the earliest of copper mining districts and the axe shown in our second view was made at the time that copper was being mined there. It may not be as old as the one shown in the first view but it was evidently made before the age of iron, else it would not have been made of copper or bronze.

In the third view will be seen one found in China and bearing marks which being deciphered indicate that it was made fifteen hundred years before Christ. The design and workmanship as will be seen is exceptionally neat and attractive, but why the crooked handle attached to the top of the axe was still adhered to is hard to explain. While the axe, in general appearance reminds one of the Irish axe shown in our last article, it has some features which might be considered as improvements on any of the former ones. For instance the bridge wall and the strap attachment are dispensed with. The bent end of the handle is fitted into the round sleeve on the top and a rivet through the hole shown keeps it in place. This axe while crude as a tool is excellent in regard to design and workmanship. It is in perfect condition after thirty-four centuries and shows good taste on the part of the designer, neat workmanship on the patternmaker's part, and a good knowledge of foundry work on the part of the man who made the casting.

In the fourth view is another Chinese axe made at about the same time as the one just described but evidently by a different family of Chinese. One way in which the different patterns would appear to be in use at the same period is that the Chinese method of recording history is to keep track of the dynasty in which it took place. This dynasty might last through several centuries and the fashion might change several times during this period. When we say that an article was made fifteen hundred years before Christ we know that it was at least that long ago, because the dynasty of Lung or Chang or Ting or whichever happened to be reigning came to a close at that date.

While the axe might seem like a strange specimen to select as an example of the progress in metals, it seemed to be the most suited for the subject, since cutting tools were evidently the first articles to be made from metal, and the ten views of the axe, which I have shown in these articles show a very satisfactory idea of how the ancients struggled to improve their tools at a time when they had no precedent to guide them.

Any further illustrations on a simple

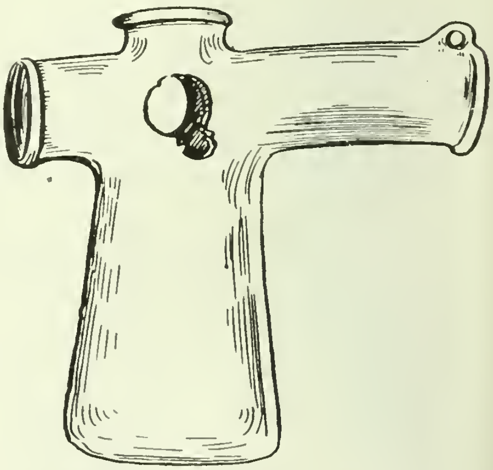


CHINESE, 1500, B.C.
BRONZE BEFORE IRON

subject such as this, would be of little interest, but in future papers I will endeavor to show some of the progress which was made in metal working of a different grade.

THOU ART THE MAN

One man is responsible for your past and for your future. That man can make you what he will; it is up to him whether you will be a success in life with everything that success can give or whether you will be a failure, whining over what might have been. That man is yourself.



CHINESE, 1500. B.C.
BRONZE BEFORE IRON

Oxy-Acetylene Welding and Cutting Blow Pipes

Tests of Different Apparatus—Weighing Quantity of Gas Consumed—Accurate and Fair Records Should Be Kept—Better Understanding of Blowpipe Flame Necessary to Economy

By ROBERT S. JOHNSTON

AT THE request of the Standardization Section, Purchase Branch, Purchase, Storage, and Traffic Division of the War Department in the States, the Bureau conducted an investigation of the operation, efficiency, and safety of oxyacetylene welding and cutting blowpipes. Apparatus from fourteen different manufacturers were submitted to test. The tests were decided upon after a careful survey had been made of the technical literature on the subject and a thorough study made of the various operations in which these blowpipes are used. Suggestions for methods of tests were also secured from the manufacturers.

All blowpipes were submitted to a standard series of tests, which were developed with the idea of minimising the personal equation of the operator and securing data that were representative only of the blowpipe itself. In order to accomplish this result a rather elaborate testing equipment, consisting of a weighing system, a gauge-board equipment, welding table, cutting table, and safety and flashback testing apparatus, was designed and used throughout the investigation.

Gas Consumed

The weighing system was used to determine the amount of gas consumed in any blowpipe operation, the process consisting in determining the loss of weight of banked tanks of oxygen and acetylene. In order to transfer the loss of weight into cubic feet of oxygen and acetylene consumed, special studies of the density of oxygen and acetylene were made. The gauge-board system comprised a flow meter designed and calibrated for this investigation, which was used to furnish a check upon the quantity of gas consumed in the welding and cutting operations, and also to secure data that would show the fluctuation of gas volumes used at different periods of time during a test.

Special care was taken to furnish the gas delivered to the blowpipes at the pressure specified by the manufacturers. To accomplish this, special compound manometers were designed and used throughout the investigation, Bourdon tube gauges being used only as a check apparatus. Besides observational data of the gas volume being consumed as indicated by the flow-meter differential manometers and the pressures delivered to the blowpipes, autographic recording gauges were also installed to secure graphical representation of the pressure fluctuations.

All welding blowpipes were submitted to welding tests on ½in. and ¾in. metal. The operation of the blowpipe, however, was necessarily performed by experienced operators. For the cutting tests the blowpipes were mechanically guided and controlled, so that practically all personal equation of the operator was eliminated. During the cutting tests the blowpipes were operated at the maximum speed at which they would cut metal of specified thickness. ½in., 2in., 6in., and 10in. metal were used in the cutting tests.

A further series of tests was made to determine the freedom from flashback and safety of operation of the various welding blowpipes.

The results of the initial series of tests carried out on the welding blowpipes indicated that there were some phenomena in connection with the operation of a welding blowpipe that were not understood. A very thorough study of the design of the various welding blowpipes was therefore made, and certain conclusions relative to the cause of inconsistencies in action noticed were arrived at. A supplementary series of tests was then carried on to prove the correctness of these conclusions. From this secondary investigation it is shown that the proper principles upon which the design of oxyacetylene-welding blowpipes should be based were probably not fully realized. The results of this entire investigation may be summarized as follows:

Cutting Blowpipes

1. There is to-day no generally accepted theory for proportioning, for the cutting of metal of various thicknesses, the volume and velocity of the issuing cutting jet, with the result that none of the apparatus submitted to test proved economical for all thicknesses.

2. There is for any thickness of metal cut a limiting velocity of exit of the cutting jet at which complete utilization of the oxygen takes place, and there is a limiting value for the amount of oxygen required to produce a cut.

3. An increase in acetylene consumption, in oxygen consumption, or in the velocity of exit of the cutting jet beyond the limiting value, does not produce increased efficiency in commensurate ratio.

4. A large majority of the blowpipes tested were equipped with excessive pre-heating flames for the thickness of metal the tip is specified for, and such excessive-sized flames are disadvantageous both from the standpoint of economy of operation and quality of work performed.

5. Considerable improvement in economy of operation seems possible in cutting material of 2in. thickness; possibly this condition may be found to exist for metal of other thicknesses than those used in the tests.

6. The maximum thickness of metal that may be economically cut with an oxyacetylene blowpipe of standard design, when neither the material nor the oxygen is pre-heated and the cutting is done from one direction, is about 12in.

7. Cutting blowpipes, due to their incorrect design, are subject to the same flashback troubles found in the welding blowpipes.

Welding Blowpipes

1. The blowpipes most subject to the so-called phenomena of "flashback" are those in which the oxygen is delivered at a pressure in excess of that at which the acetylene is delivered.

2. All blowpipes tested, including those in which the acetylene is delivered at an excess pressure, as well as the so-called equal or balanced pressure blowpipes, are subject to flashback phenomena on account of inherent defects in their design.

3. The cause of the development of the conditions producing flashback is the setting up, within the blowpipe tip and head, of a back pressure which retards or chokes off the flow of one of the gases.

4. This back pressure is the result of confining or restricting the volume flow of the issuing gases at the tip end.

5. Any cause tending to restrict the flow of the gases sets up a back pressure which immediately causes a change in the amount of each gas delivered to the mixing chamber.

6. A fluctuating gas-volume ratio, due to restriction of volume flow from whatever cause, prevents a blowpipe from maintaining constantly and at all times during operation the desired "neutral flame."

7. A blowpipe that cannot maintain under all operating conditions a neutral flame cannot logically be expected to produce sound welds.

8. All the blowpipes tested during this investigation either through improper gas pressure or improper interior design, or both, are incapable of maintaining a neutral flame (constant volume gas ratio) under all conditions of restricted gas flow, and are therefore incapable of producing sound welds where there is any liability of the gaseous products of combustion being momentarily confined, such as occurs in practically all welding operations.

(Continued on page 29)

Comments by Two Americans on F. J. Cook's Paper

Both Consider His Paper Full of Information, But Do Not Think He Gave America Exactly the Best Front to be Judged By

IN THE last issue of Canadian Foundryman we published a number of written discussions on the paper read at the Rochester convention on the subject of "American versus British Gray Cast Iron" by F. J. Cook of Birmingham. The two following letters by Americans, prominent in the gray iron field will be read with interest. Editor:

It is with the closest interest that I have read this spirited and wholly praiseworthy exchange paper. As an international paper it is admirable because of the insight it gives Americans into important points of British gray-iron metallurgy, and because of its very attractive controversial possibilities. The paper cannot help but redound to the great good of gray iron theory and practice in both Great Britain and the United States.

There are two kinds of iron castings—those made from appropriate iron especially formulated for the particular castings, and those made from common nondescript cast iron which while broadly useful is not generally a felicitous choice for particular requirements. We suspect that Mr. Cook is comparing, in parts of his paper, British iron of the first class with American iron of the second. If our British friends have found some American machine tool castings faulty it is possible that they belonged to the last class; especially would this be true if said castings were made under stress of war conditions when some manufacturers found their own foundries too small and were forced to let out a part of their castings with a lack of discrimination that often was unavoidable. In this country as in England it is possible that machinery builders who make their own castings have the iron under intelligent control producing castings equal in every way to the demands of the intended service. I am a persistent advocate of specialization in foundry irons and therefore hail this part of Mr. Cook's paper with special satisfaction because it adds emphasis to a point all too little realized in some engineering circles. There is far too much needless obloquy attached to cast iron simply because a few manufacturers through either ignorance or carelessness are habitually allowing questionable grades of iron to enter into important castings.

Mr. Cook mentions reported failures of cast iron parts in America under exposure to superheated steam. This phenomenon of growth and warping under superheated steam has been referred to by American writers with more frequency and emphasis than are justified by the instances of its occurrence. A search of technical literature shows that the most of the references go back either directly or indirectly to three papers read before the American Society of Mechanical Engineers over twelve years ago. The number of cases reported since then is very small. These mentioned are not to be denied but my long experience in this line convinces me that when fittings intended to handle superheated steam are made from appropriate iron the danger of failure is remote except possibly where most uncommonly high degrees of superheat are used. I have yet to see the first valve or fitting made of suitable iron that has failed under this service. It is certain that cast iron parts made by American manufacturers specializing in this line and making their own castings, are made of iron entirely capable of encountering successfully the feared but somewhat overestimated superheat peril.

The average of over 36,000 pounds per square inch tensile strength attained by Mr. Cook bespeaks the sterling foundryman and suggests that his iron falls within the category of special irons; at least it would be unfair to set it up against iron of the common variety. Quite interesting in this same connection would be a record of strengths of iron melted in the average English jobbing foundry. I myself have seen many hundreds of heats of iron run without the aid of steel additions, having an average tensile strength corresponding almost identically with that obtained by Mr. Cook; the iron, however, was formulated for a particular purpose and should not be compared seriously with the product of the ordinary foundry catering to a not fastidious trade. Mr. Cook's tensile and "arbitration" strengths in Table 1 are highly commendable but should not reflect unfavorably upon American iron because his bars were cast on the main castings while the arbitration bars were cast separately. It is well known among foundrymen that test bars can be located so favorably in relation to the main casting, when "cast on," as to give great advantage to the bars even to the extent of giving a grossly exaggerated indication of the true strength of the iron in the main casting.

The attempt to reconcile the strength of the -¼ inch round American arbitration bar with that of British one-inch square bars by use of the factor 0.74 is not to be commended because no account seems to be taken of the quite different manner in which square and round section bars form crystals while cooling. Mr. Cook used this same device in his very able and keen discussion of my exchange paper before the Institution of British Foundrymen last year which is referred to by him on page 8 of the preprint of the present paper where he calls attention to the fact that his lowest "equivalent load" (evidently obtained through the 0.74 factor) was higher than the transverse strength of electric furnace refined iron mentioned in my paper. Mr. Cook seems to take it for granted that the strengths mentioned in my paper were exceptional for American iron. This was far from being the case; they were not given as being the last word in cast-iron test-bar strengths but rather as illustrations of the improvement wrought in irons of somewhat lowly origin by treatment in the basic-hearth electric furnace. The strengths were shown in pairs so as to depict the same iron before and after treatment, and so doing fulfilled their only mission of showing that the process materially improved the original cupola metal. That the strengths were in any way exceptional was not claimed. Purposely did I avoid injecting the phenomenal into the paper which fact does not seem to have been understood by several British commentators.

In the case of carbon in cast iron, I am sure it will be found that more iron foundries in this country pay attention to it than Mr. Cook suspects. These naturally do not include the great rank and file of unspecialized foundries already mentioned but only such as make the better grades of castings. In making fittings for superheated steam for instance, certain foundries pay great attention to the amount, the size and the distribution of the free carbon.

The sulphur question is taken up in the paper and it is safe to assume that this is one question that never will be settled to the satisfaction of everybody, especially of persons who through geography or economy are somewhat inescapably tied fast to high sulphur. To a less extent this also is true of phosphorus in considering which Mr. Cook makes the important observation that its distribution is of utmost importance, that segregated phosphate is more dangerous than the uniformly distributed. It is my belief that high phosphorus and high sulphur will become less dangerous only when foundrymen learn a way to produce without fail, both phosphides and sulphides in a certain optimum degree of dispersion and of certain critical particle size. I do not believe that foundrymen have yet learned the way to do this but discussions such as Mr. Cook's will aid greatly in throwing the desired light upon the subject. As matters now stand it seems that sulphur and phosphorus are safest when absent.

I am much pleased to see Mr. Cook refer to tests of a more dynamic nature than the usual tensile and transverse tests. It is to be hoped that a more general adoption of dynamic or shock tests is near at hand for I believe these tests will greatly increase our knowledge of the differences between irons now apparently the same as far as the usual static tests go and yet which do not show up the same in service. I have in mind two sets of valve body castings weighing about six hundred pounds each that were broken up under a foundry drop-weight. One set was made from iron having about 0.08 per cent. sulphur and an average of two drops of the weight was necessary to break each casting. The other set was made of the same iron but refined in the electric furnace, with sulphur at about 0.035 per cent.; these castings required four or five drops each to be broken. By transverse test the second iron was about thirty-five per cent. stronger than the first, by the drop test it was over a hundred per cent. stronger.

The theory advanced in the paper and attributed to Mr. J. E. Fletcher, concerning the relative effects of hot and cold blast furnaces upon the structure and properties of gray iron, is, by way of contrast, strongly suggestive of the thought advanced by the late J. E. Johnson in his theory of oxygenated iron. Johnson's theory is that the cool running charcoal blast furnace causes a certain marked oxygenation of the iron which condition in turn, he contended, effects a compactness of the graphite formation that is not to be found in the product of the hotter running coke blast furnaces. On the other hand, Mr. Cook bases his claims for superiority in the iron from the cool running furnace, upon a quite different assumption—that through lack of oxidizing conditions a certain boundary — intercohesional strength is preserved in the metal. Therefore, we are confronted with two theories, both touching upon the question of oxygen, and both claiming excellent properties in iron made in cool blast furnaces. One however, attributes the superiority to oxygen picked up under the named conditions while the other declares the iron to be superior because the same given conditions are not favorable to the taking up and retention of oxygen. Both theories touch upon fundamentals of the greatest interest but neither is convincing and we feel justified in demanding more and better evidence.

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DISCUSSION OF PAPER BY MR. F. J. COOK ON AMERICAN VERSUS BRITISH GRAY CAST IRON

I HAVE just read, with great interest Mr. Cook's paper on American versus British Gray Cast Iron. The interchange of ideas between the two countries, as done in these exchange papers is always interesting as well as profitable. Mr. Cook, in particular, has advanced a number of original and unique ideas. It is a great pleasure to note his development of the metallography of cast iron. This is as complex as that of steel and has not received sufficient attention. If it were possible, we would be very glad to examine one of their specimens of cast iron in order to see just what he means by the distribution of phosphorus. Some of us always believed that phosphorus to the extent of 1 per cent. has an unfavorable action on the physical properties of cast iron.

It is unfortunate that he limits his comparison of physical properties to irons made without the addition of steel in the cupola. This is the common practice in most American foundries and is the method by which we usually make our high test irons. He can not mean to criticise our material and then exclude from consideration or comparison our best grade.

We note that he quotes from only one grade of irons. It would be interesting to know if they use the same grade for all castings.

Referring to his comments on traverse and tensile strength, will say the results he shows are extremely good, probably better than most foundries in this country would show. It is difficult to compare tests on transverse bars of various sizes. It is our practice to use a bar 1 x 2 x 24 inches between supports, broken with flat side down and loaded in center. In the last three months, we have tested 55 sets of such bars for an inspected job, with average transverse load of 3055 lb. and the deflection of .54 inches.

On one recent order, the 82 sets of tensile bars cast for the job averaged 32,700 lb. per square inch. On another similar order, the 85 sets of tensile bars averaged 33,670 lb. per square inch. All our bars are cast in separate molds and the tensile bars are cast 1⅝ in. round by 14 in. long. The ends are rough machined and middle of bar turned to about 1 in. in diameter for a space of 2 inches.

The above bars represent all the tests made and were not selected for their high value. They represent our medium grade material and not our hardest grade material from which we made our cylinders, liners, etc. Transverse bars of this latter mixture (1 x 2 x 24 inches, as above) have gone as high as 4280 lb. This would be considerably over 40,000 lb. per square inch in a tensile bar.

Two tensile bars recently cut from the bore of a liner for our 48 in. diameter gas cylinders broke at 36,080 and 36,480 lb. per square inch. This liner weighed about 5000 lb. in the rough with a metal thickness of about 1 1/2 in. The Brinell hardnes of the casting was 183 taken on finished bore. (Micrograph herewith.)

Another bar just cut from a full sized prolongation of a 44 in. diameter gas engine liner showed 37,960 lb. per square inch. The hardness of bore after machining was 192. This casting weighed 4300 lb. in the rough with metal thickness of nearly 1 1/2 inches. These tensile bars were turned to .25 in. diameter with threaded ends. In view of their being cut from a large casting, we feel these tests represent as good material as any to which Mr. Cook refers.

Would say that while we have made tests of our class "A" iron showing over 40,000 lb. to the square inch, we do not make any tensile test bars for castings made from this mixture. The tests bars are apt to be mottled and extremely difficult to machine. In place of so many tensile bars, we are now making more hardness tests on the finished castings. It might be noted in this connection, that the length of wear of cylinders or liners is not determined by their tensile strength, but by their hardness and closeness of grain. Another reason why the tensile test bar is not more used in this country is that the cost is over twice that of a transverse bar.

We would be inclined to agree with Dr. Moldenke in his statement that the average testing machines in this country do not pull absolutely in line, which naturally reduces the reported tensile strength.

The question of fillets is of extreme importance. Some time ago, one of the A. S. T. M. Committees on cast iron, found that by making the fillet on our standard cast iron test bar much easier, the tensile strength could be increased by an average of over 3,000 lb. to the square inch. This change, I believe, will soon be officially adopted.

Referring to the diagram shown on the eighteenth page of Mr. Cook's paper, would say that a machine of this type has been set up in one of our neighboring foundries for 20 years. It varies from his, only in being graduated in inches and the weight being dropped by a trip.

There is no doubt that many of our American castings are made too soft. On this point, I believe, we are open to criticism. Too much attention is given to ease off machining. This has been done purposely, however, and not because it was impossible to furnish close grained and strong material.

In regard to breakage of American made fly wheels, I wish to quote our Power Dept. as follows:

"The practice of the Allis-Chalmers Manufacturing Company is to run cast iron fly wheels for engines up to a peripheral speed of 6,000 ft. per minute. During the past forty-five years, we have built more than 7,000 engines, aggregating over 6,000,000 horse power. During this period, we have had only two or three reported fly wheel failures which in each instance were directly traceable to overspeeding due to some breakage or failure of the governing devices.

'In our mill practice, the standard peripheral speed of cast iron band saw wheels is 10,000 ft. per minute with occasional speeds of 11,000 ft. per minute. None of the several hundred wheels of this type built within the past twenty years have failed in service and but one or two, after periods of fifteen to seventeen years' service have required replacement due to local conditions. Out-

(Continued on page 29)

Aluminum and Aluminum-Alloy Melting Furnaces

Review of the Work Undertaken by the United States Bureau of Mines to Decrease Metal and Fuel Losses in Melting Prepared for the Rochester Convention

By ROBERT J. ANDERSON

As has been mentioned, stationary iron-pot furnaces are favored considerably for melting ingot aluminum alloys in foundry practice. These furnaces may be run as separate units or as a battery of more than one pot to a furnace; the practice of employing two or three pots to a furnace has several advantages. Oil or gas is generally used for fuel. At the present time, stationary iron-pot furnaces are run without cover, in most foundries, although some foundrymen are still strongly disposed to use solid cast iron covers on small units. Stationary iron-pot furnaces are built in various capacities up to 400 pounds of No. 12 alloy, and 250 pounds is a common size. The pots may be either round or rectangular in shape, but they are usually round. In the stationary iron-pot furnace, the pot is heated over its exterior surface by the combustion of fuel in the space between the furnace walls and the pot. Normally, the products of combustion do not have an opportunity to come in contact with the alloy during the melting. Ordinarily, a liquid heel of 50 to 150 pounds of alloy is left in the pot so as to conserve the heat and also to facilitate alloying, and additional cold metal is charged to the heel after drawing a heat. When a charge is melted, the alloy is ladled out of the pot and poured.

Stationary iron-pot furnaces are manufactured by a number of furnace makers and in some foundries they are built by mechanics in the plants. In the case of single units, the furnace consists of a round, square, or rectangular steel shell, lined with refractory brick, and the top is covered with a sheet steel roof lined with refractory material, with a hole in the centre for setting the pot. The latter is hung from the top of the furnace and may be supported by wedge-shaped bricks at the centre or a refractory stool beneath. One burner is used in single units. The burner should be so placed that the flames are not projected directly against the pot but rather around it, and the products of combustion are discharged through a small vent at the rear near the top. In some installations, the products of combustion are discharged through the flue directly into the air, while in others, the small vent leads to a large connecting flue, as in pit furnaces, and thence to a stack. With one furnace, a small stack may be connected directly to the vent. In the case of installations where two or more pots are placed in a furnace, a burner is used at each end. The pots are charged so that the burners are used alternately. Thus, in the case of a two-pot furnace with a charge of liquid metal in one pot and of cold metal in the second pot, the first burner nearest the first pot would be operating, and the second pot would be pre-heated by the hot gases. After pouring the first pot, it would be charged with cold metal, the first burner turned off and the second one started.

This principle is employed in some double chamber tilting crucible furnaces and in double chamber tilting open-flame furnaces. At the present time, the iron-pot furnace (stationary and tilting) is the most extensively employed for melting in foundry practice from the standpoint of tonnage turned out.

In the United States, the capacity of stationary iron-pot furnaces varies from 100 to 400 pounds of No. 12 alloy in the case of circular pots and from 600 to 1,200 pounds for the rectangular pots. The circular pot holding 300 pounds of alloy is a common size; this may be bowl-shaped, 18 inches in diameter by 18 inches deep. A typical rectangular pot is one 16 inches wide by 37 inches long by 26 inches deep; this holds from 1,000 to 1,200 pounds of alloy. Iron-pot furnaces of the stationary type are lined usually with a 4-inch thick lining of fire-brick, although silica brick, carborundum fire sand, and commercial high temperature cements are used in practice. Covers are generally used on single unit iron-pot furnaces; such covers are simply dome-shaped covers made of cast iron about 1 inch thick. In large installations of these furnaces, covers are not employed usually. Oil is the preferred fuel for use in iron-pot furnaces; natural gas is used to a less extent, while illuminating (city) gas and blue water gas are employed in a few installations. Details of the burner equipment and air supply for iron-pot furnaces of the stationary type cannot be included here, but a typical installation may be cited: Pressure of air at the burner, 1.5 to 2 pounds; pressure of oil at the burner, 25 to 30 pounds; Anthony burner.

From one to eight furnaces are handled per furnace tender in practice, and from 100 to 2,400 pounds of alloy per hour are melted, as reported. The fuel consumption in these furnaces is very variable, reported figures varying from 1.25 to 5 gallons of oil per 100 pounds of alloy, and from 150 to 1,000 cubic feet of natural gas, equivalent to furnace efficiencies of from 5.7 to 57.3 per cent. In general the average fuel efficiency in these furnaces is higher than in pit or crucible furnaces. Melting costs for fuel in iron-pot furnaces of the stationary type, using oil, vary from $0.10 to $0.40 per 100 pounds of alloy. From three to 10 heats are taken per day, and the melting period varies from 45 minutes to three hours, depending upon the size of the charge. This is equivalent to a melting time of from 12 minutes to one hour per 100 pounds of alloy. Roughly, it may be said that at least seven 300-pound heats should be obtained per furnace per nine-hour day, with an average melting period of 1.25 hours. A molten heel is used generally in iron-pot furnace practice, where it is generally recognized as advantageous. In the majority of plants, a heel of 50 to 100 pounds will be retained in the furnace after drawing a heat, and cold metal is charged to the heel.

The life of linings in stationary iron-pot furnaces is variable, from three to 12 months being reported. This is equivalent to from 225 to 1,300 heats, with an indicated average of six months and about 1,000 heats The life of iron pots varies from 24 to 80 heats, as reported, with an indicated average of 47 heats, equivalent to about 14,000 pounds of metal for a 300-pound pot. The gross melting loss in these furnaces varies from 2 to 6 per cent., with an indicated average of 4.2 per cent. This is equivalent to a net melting loss of 2.5 per cent. Iron-pot furnaces may be regarded as fairly satisfactory for melting aluminum alloys in foundry practice, particularly where the output is fairly large. They are easy to handle and the labor cost for melting should be low. In actual practice, they are seen to be more efficient as to fuel consumption than pit or crucible furnaces although the melting losses appear to be higher.

Tilting Iron-Pot Furnaces

Tilting iron-pot furnaces, as used in foundry practice for melting light aluminum alloys, are usually fired by oil or gas. One installation where coke is used for the fuel has come to the attention of the author, but this is to be replaced by an electric furnace. Tilting iron-pot furnaces are invariably operated as single units, and their general construction is similar to that of the stationary iron-pot furnace. A cast-iron pot is mounted in a furnace shell, and the pot is heated over its exterior surface by combustion of the fuel. As a rule, the capacity of the tilting furnace is larger than that of the stationary furnace using circular pots. Thus furnaces with capacities of up to 600 pounds of No. 12 alloy are built, and 300 pounds is a common size. In contradistinction to stationary iron-pot furnaces, the tilting iron pots are generally run on strictly intermittent heats.

No molten heel is used, and the inside of the pot is scraped thoroughly after each heat. It is easier to clean a tilting pot than a stationary one. On the other hand, the practice of employing a molten heel is also in force at some plants using the tilting furnace.

The pots used in tilting furnaces are always circular in shape, no rectangular pots having been employed in this type. The products of combustion do not have much opportunity to come into contact with the alloy during melting since the pot is heated over its exterior surface by combustion of the fuel. Where the waste furnace gases are discharged through openings at the top of the furnace adjoining the upper rim of the pot, there is opportunity for the gases to come into contact with the metal. However, in both stationary and tilting iron-pot furnaces, the metal may be regarded, for all practical purposes, as effectively protected from the products of combustion, in contradistinction to the open-flame furnaces where the incandescent combustible gases are directly in contact with the metal during the melting period. The tilting furnace presents some definite advantages over the stationary type, since in the case of the latter the liquid alloy must be ladled out into pouring vessels with resultant additional oxidation and also with much spattering and spilling. Under foundry conditions, the amount of furnace scrap (spills and pouring skims) is usually less than when the stationary furnace is used.

In general, the performance of tilting iron-pot furnaces is similar to that of the stationary type, as to operating details, and further data need not be included.

Open-Flame Furnaces

Open-flame furnaces of various designs are favored by some foundrymen for melting light aluminum alloys, principally because of the rapidity of melting that is obtainable. These furnaces, also called direct-flame furnaces, consist of a sheet steel shell, either pear-shaped or cylindrical, lined with a refractory material, and mounted on trunnions. The principal types include the following: pear-shaped (upright) tilting furnaces; cylindrical stationary furnaces; cylindrical tilting furnaces; and cylindrical rotating and tilting furnaces. Open-flame furnaces are fired by oil or gas, and the combustion of the fuel takes place in the space directly above the surface of the metal bath; the alloy is in intimate contact with the products of combustion during melting. In the case of the small single-unit pear-shaped (upright) furnace, two burners are placed in the side at a point midway between the charging door and the pouring spout. The furnace is charged through the door at the top, and the metal is poured by tilting the furnace to the proper position. The pear-shaped shell is mounted on trunnions. This type of open-flame furnace may be lined with fire brick or with a rammed lining of gannister and fire clay. Usually, rather small furnaces are employed for melting aluminum alloys, a furnace 42 inches in diameter being a common size, although furnaces up to 75 inches in diameter are used. The operating capacity of the former may be taken as about 300 pounds of No. 12 alloy.

Another form of open-flame tilting furnace is the double chamber type This consists of two egg-shaped shells, lying with their long axes horizontally, mounted on trunnions with a connecting space between the two chambers. The charging doors are placed at the top of each shell and the shells may be tilted individually. Another design of open-flame furnace is the cylindrical or barrel-shaped furnace. A burner may be placed at one end or one burner may be placed on either side of the furnace near the top. These furnaces are usually of large capacity, and they are built to hold up to 3,000 pounds of No. 12 alloy. One design is said to be capable of melting 3,000 pounds of aluminum alloys per hour, or at the rate of 100 pounds in two minutes. These furnaces may be built with two charging doors at one side and one at one end; the pouring spout is placed at the other end. Another type of furnace is the barrel-shaped tilting furnace; the construction is similar to that of the pear-shaped furnace but it is simply different in shape. A charging door is built in the top, and a pouring spout is placed in one side. One burner may enter through one trunnion, or one or two burners may be placed through the walls near the top.

A barrel-shaped rotating and tilting furnace has been brought out recently. This furnace is made to rotate but it is tilted at right angles at the direction of rotation for pouring. One burner is placed so as to project flame through a hole at one end; the products of combustion are discharged through the pouring spout at the other end. Some other types of open-flame furnaces are on the market, but their use for melting light aluminum alloys is not known. With particular reference to the open-flame furnaces mentioned above, the pear-shaped (upright) tilting furnace is the most extensively employed of this type for melting light aluminum alloys. The large stationary cylindrical furnace and the rotating and tilting furnace are coming into use now in both foundry practice and elsewhere.

Most of the data to be given below is for pear-shaped (upright) open-furnace tilting furnaces, and the remarks made should not be applied indiscriminately to all types of open-flame furnaces. Open-flame furnaces are very variable as to capacity, but, as indicated above, the pear-shaped (upright) furnace having a diameter of 42 inches and taking from 200 to 300 pounds of No. 12 alloy appears to be the most favored. These furnaces may be lined with a 4-inch thick lining of fire brick, although carborundum fire sand is used considerably. In one installation, a rammed lining of gannister and fireclay, 3 inches thick, is employed. Natural gas and oil are used for the fuel, the latter being preferred. On this installation, the pressure of the air at the burner is from 16 to 18 ounces, and the pressure of the oil is 40 pounds, using a burner supplied with the furnace. In practice, one or two furnaces are handled per furnace tender, and from 200 to 600 pounds of No. 12 alloy are melted per hour. The fuel consumption in these furnaces is variable; in one furnace it was 450 cubic feet of natural gas per 100 pounds melted, while in another, it was 2 gallons of oil. These figures are equivalent to efficiencies of 12.7 and 17.5 per cent. respectively. In general, the fuel efficiency in open-flame furnaces of most types appears to be substantially higher than in the furnaces heretofore discussed. Melting costs, for the two furnaces just mentioned, are $0.18 and $0.16 per 100 pounds of alloy.

Open-flame furnaces are the most rapid fuel-fired melting furnaces. Thus, in one plant, with an oil-fired furnace of the pear-shaped (upright) tilting type, six 300 pound heats are obtained in nine hours, with an average melting period of 30 minutes. This is equivalent to a melting time of 10 minutes per 100 pounds of alloy. The life of linings in these furnaces varies, of course, depending on a number of factors. In one plant, a 4-inch thick fire brick lining had a life of about three months giving 600 heats, melting 200 pounds of No. 12 alloy per hour, nine heats per day. This is equivalent to about 125,000 pounds of metal melted. In another plant, a 300-pound furnace with a 3-inch thick lining of rammed gannister and fire clay gave six heats per day and lasted for four years. This is equivalent to 7,200 heats and a melting output of about 2,100,000 pounds of metal. The average gross melting loss in open-flame furnaces is generally high, although this is governed principally by the furnace atmosphere and the temperature. As reported, this ranged from 4 to 8 per cent. in practice, with an indicated average of 6.7 per cent. This is equivalent to a net melting loss of 4 per cent. Open-flame furnaces are very rapid melting furnaces, and their efficiency as to fuel consumption is relatively high. They give rise to heavy oxidation losses unless the furnace atmosphere is lean in oxygen and it may be that such control of the atmosphere will result in heavy fuel losses.

Reverberatory Furnaces

Reverberatory furnaces are used to some extent for melting light aluminum alloys in foundry practice but chiefly for melting aluminum for casting into rolling ingots. Their capacity is small as compared to reverberatory furnaces used in brass and copper practice, and they are generally built to hold 500 to 6,000 pounds of aluminum. There are two general types of reverberatory furnaces: (1) those in which the liquid metal is ladled out through a door, and (2) those in which a tap hole and runner are used for tapping. Furnaces of large capacity are required in aluminum rolling mill practice, and it is largely for this reason that reverberatory furnaces have been preferred for ingot casting. In foundry practice, the reverberatory furnace is applicable where the output is large and continuous, but it is necessary that the production of castings be so planned that large heats of metal are not held in the furnace for long periods of time. The "soaking" of aluminum heats in rolling mill practice does not appear to be so deleterious to the quality of the metal as it is to aluminum alloys in foundry practice. The reverberatory furnace is of value also in foundry practice because it permits the charging of large scrap, such as defective crankcases and the like, without breaking. In smaller furnaces, such as the iron-pot furnaces and stationary crucible furnaces of the usual sizes, it is generally necessary to break up all large scrap to admit of charging it. Reverberatory furnaces are used also for running down borings and other scraps in the production of secondary aluminum and aluminum-alloy pig.

The usual type of reverberatory furnace aluminum alloys consists of a fire brick shell bound together with steel girders (channels and I-beams). The hearth is hollow and usually is built of fire brick while the roof is arched over from one side to the other and generally arched down from front to back in order to deflect the flame and hot gases from combustion down upon the metal. Reverberatory furnaces are fired with coal, oil, or gas. When coal is used, the fuel is burned upon a grate placed in a fire box at the front of the furnace; natural draft is generally used. When fired by oil or gas, the burners are placed usually in the sides of the furnace. The products of combustion are led to a stack via a flue at the rear. In the case of furnaces fired by oil or gas, two to four burners are used.

Reliable data as to the performance of reverberatory furnaces on aluminum alloys are scarce, but in general the remarks made as to pear-shaped open-flame tilting furnaces above will apply here.

Electric Furnaces

A great many types of electric furnaces are on the market at the present time, and a number of these have been especially designed for the melting of non-ferrous metals and alloys, particularly brass. No furnace has been designed especially for melting aluminum and its light alloys, although a number of the standard electric furnaces have been used for this purpose. The idea has been held by some that a superior quality of metal would result from electric furnace melting, but the electric furnace is to be regarded rather as a melting medium for metal rather than an appliance to convert poor melting stock into material of better grade. It may be stated parenthetically that the electric furnace has been advocated by some on the ground that melting in a "reducing" atmosphere would make it especially applicable for aluminum alloys, but there are no actual data which are available in support of this contention. The industrial electric furnaces on the market which have been used either experimentally or commercially are discussed briefly below, and reference may be made to the series of papers by H. W. Gillett in The Foundry on the electric melting of alloys for detailed information as to the various types of electric furnaces which are employed for the melting of non-ferrous metals in general.

The Baily granular-resistor electric furnace was the type first used commercially, in 1918, for melting aluminum and aluminum alloys, the installation of a 500-kilowatt rectangular furnace at the Massena, N. Y. plant of the Aluminum Co. of America being the first installation, although the tilting type of this furnace had been tried experimentally for aluminum alloys before this time. The large rectangular stationary furnace consists, briefly, of a steel shell with a lining of high grade fire brick and the shell. The hearth is bowl-shaped and has a capacity of three to four tons of liquid aluminum. There are doors at both ends of the furnace, together with rabbling doors on the side opposite the tap hole. This furnace is stationary, and the metal is tapped by pulling out a plug from the tap hole. Running lengthwise of the furnace, there are two resistor troughs made of refractory material and filled with resistor carbon or graphite. The troughs are supported on brick piers. Electric current is sent through the resistor troughs, contact being made through copper terminals at the ends. The heat generated in the trough is radiated largely to the roof of the furnace and then reflected down upon the hearth.

The Baily-type, tilting electric furnace is installed in a few foundries for melting aluminum alloys The standard 105-kilowatt furnace consists of a cylindrical steel shell mounted on trunnions and arranged with a mechanism so that it may be tilted by hand. A circular refractory trough filled with crushed carbon-resistor material and mounted on a series of refractory piers is the heating element. Current connection is made to the resistor element by means of copper leads terminating in graphite blocks packed against the resistor material. The metal is melted on a hearth below the trough by the heat radiated from the incandescent resistor to the roof and then reflected downwards. The furnace shell is about 7 feet high by 6 feet in diameter, and the capacity is about 500 pounds of No. 12 alloy. The hearth is made of carborundum fire sand, and the roof and sidewalls are lined with corundite brick. A backing of infusorial earth is packed in between the lining and the furnace shell. The current consumption is stated to be about 680 kilowatt-hours per ton of aluminum alloys melted. The furnaces are built in several sizes.

The Detroit-type indirect-arc rocking electric furnace is used commercially for melting light aluminum alloys in foundry practice. This furnace consists essentially of a cylindrical steel shell lined with a layer of corundite brick, which is backed by a course of a less refractory brick chosen for its heat insulating properties, and this in turn is backed by brick or infusorial each next to the steel shell. The furnace is built in various sizes, but the 1-ton furnace for brass takes about 700 pounds of No. 12 alloy. The furnace proper is mounted on rollers and ring gears which permit it to be rocked through any arc of revolution up to 200 degrees. The motion is actuated by a small induction motor through reducing gears, and the action of the motor is controlled by an automatic reversing switch which may be set to give the desired angle of rock. The heat is generated by an eletric arc from two horizontal graphite electrodes placed axially in the furnace and meeting in the centre of the chamber. The electrodes are controlled by hand wheels, and automatic regulation may be applied. During the charging of metal, the electrodes are run back out of the way of the charging door. To operate, the furnace is closed, the electrodes are are brought to the pouring position, and the arc is started. The metal is melted by conduction from the refractory lining as well as by direct radiation from the arc. Rocking is started after the metal commences to soften, first through a small angle and finally reaching the maximum angle of rock as the metal enters the stage of superheating. The rate of rock is two complete oscillations per minute. The charging door and pouring spout are at the centre on one side of the furnace, and the furnace may be charged mechanically from above by rotating the furnace so that the door is on top.

The General Electric type electric furnace is used by the General Electric Co. at several of its plants for melting aluminum and aluminum alloys. This furnace consists of a shallow hearth in the middle of a rectangular furnace shell. Two heating troughs, placed on each side of the hearth are the source of heat. The heating troughs are filled with granular coke and two long cross electrodes are placed in the bottom of the troughs. Two vertical electrodes make contact with the cro s electrodes through wearing blocks, and the ends of the vertical electrodes are covered with the granular resistor material. The furnace is inherently two phase. Heat is developed in the resistor troughs by the passage of the current and by the contact arcs at the bottom of the vertical electrode. The heat developed is radiated to the arched roof and thence reflected to the hearth, and the body of granular material conducts heat to the sides and bottom of the hearth.

A number of other electric furnaces have been used experimentally or commercially for melting aluminum alloys, of which the Rennerfelt indirect-arc type has been employed for the preparation of so-called hardeners. The principle of heating is by reflected heat form an electric arc. The Rennerfelt electric reverberatory furnace has been suggested for aluminum melting. This furnace has two melting hearths, and the heat is generated by a resistor trough which is heated by an electric arc from vertical electrodes. The arc may be smothered in the resistor, as in the General Electric furnace, or open. The vertical ring induction furnace (Ajax-Wyatt) has not been used commercially for aluminum-alloy melting, although it is understood that it is to be tried experimentally for this purpose. The Booth indirect-type rotating furnace is similar in general construction and principle to other indirect-arc furnaces, and it may be used for melting aluminum and aluminum alloys. The direct-arc type electric furnace, of which the Snyder furnace is the only one of many of this type which has been applied to copper alloys, has not been used for the melting of aluminum alloys.

Operation of Furnaces

The principal types of furnaces which are employed for melting aluminum and aluminum alloys have been briefly described, and it is evident from the foregoing that the choice of a furnace, from a consideration of all existing types, becomes a difficult matter. In any case a choice should be based upon a consideration of (1) the capacity desired; (2) the melting loss; (3) the cost of installation; and (4) the cost of melting. These factors at least should be given careful attention and many others should be considered usually before deciding upon any given type. Detailed data as to the structural features of furnaces have not been included here because information as to this has appeared often, and it can be readily obtained from many sources.

It is frequently stated that aluminum and its light alloys readily absorb large quantities of gases on melting and that, therefore, open-flame furnaces should not be employed. Vague statements of this character are entirely useless, but, at the same, it is a matter of common knowledge that good practice calls for heating the alloys only to the temperature required for pouring the castings, and this is necessarily variable depending upon the alloys used and the type of castings which are run. Roughly, the pouring temperatures required for No. 12 alloy in foundry practice may be taken as between 650 and 880 degrees Cent. (1202 and 1600 degrees Fahr.), which covers the range for practically all commercial work, although 750 degrees Cent. is a quite common pouring temperature in heavy automotive work for oil pans and crankcases. On the foregoing basis, the melting temperature need not be more than 50 degrees and never more than 100 degrees Cent. higher than the pouring temperature to allow for any cooling that may take place during the transfer of the metal from the molds.

As a general rule, in the industrial operation of furnaces run on aluminum and aluminum alloys, the effort is made to keep the dross and oxidation losses as low as possible. Some foundrymen, however, prefer to have high metal losses for the sake of rapid melting, while others employ furnaces which are assumed to be inexpensive as to fuel consumption with the idea of keeping the melting costs low. In attempting to hold dross losses low, numerous factors involved in metal melting may be overlooked, or at least, disregarded, and the net practical result may be that the melting is exceedingly inefficient from the standpoint of fuel consumption. A cardinal rule in melting practice for aluminum and its light alloys is that the melting temperature should be kept low. The effect of increasing the temperature of melting, at least in an atmosphere containing free oxygen and nitrogen, is to increase the net melting loss.

Acknowledgments

The author is indebted to many foundrymen and metallurgists in the light alloy industry for data and information on the subject under discussion and to some manufacturers of furnaces for the use of illustrations.

DISCUSSION OF PAPER BY MR. F. J. COOK ON AMERICAN VERSUS BRITISH GRAY CAST IRON

(Continued from page 25)

side of the experience of the Allis-Chalmers Company, it would appear that fly wheel failures in America have not as a rule been due to the quality of the material, but either to overspeeding due to failure of the engine governors or to bad design of the wheels themselves."

We are greatly interested in his statement or question as to whether a slower running of the blast furnace and also lower blast temperatures would not tend to increase the strength of the castings made from resulting pig iron. It is common belief that warm blast charcoal pig iron is not as strong or as good as cold blast and it is quite possible that warm blast coke iron might be of better quality than a hot blast iron.

We would also be interested in hearing further details about the "largest foundry in the world." We have heard of many " largest" foundries and a statement as to size of building and average daily melt of cast iron, would be instructive.

In referring to Mr. Cook's belief that the American practice is to regulate the mixture entirely by silicon content, with no reference to total carbon, would say that this can hardly be the case, as a large percentage of American foundries purposely reduce the total carbon by adding steel in the cupola, which is apparently not the English practice.

We are inclined to agree with what Mr. Cook says about the influence of sulphur. The influence of this element in times past, has been much over-emphasized. The specifications of the A. S. T. M., however, allow sulphur up to .12 which is considerably in excess of .07 as desired by Mr. Elliott. I have seen any number of good gray iron castings, containing from .15 to .18 sulphur. As Mr. Cook says, manganese in these castings should be fairly high.

I am sure we all welcome Mr. Cook's criticisms and sincerely hope he will be able to take advantage of his being in this country to visit a number of our foundries and satisfy himself as to the high quality of our material.

R. S. MACPHERRAN
Allis-Chalmers Company,
Milwaukee, Wis.

OXY-ACETYLENE WELDING

(Continued from page 23)

9. The ability of a blowpipe to consume an equal ratio of gases when burning freely and undisturbed in air is no criterion that it is capable of producing sound welds—that is, that it is not subject to detrimental fluctuations in gas ratio during a welding operation, and therefore is capable of maintaining a neutral flame under all operating conditions.

10. Whether a blowpipe of present design will consume equal volume ratio of gases when burning freely and undisturbed in air depends on how nearly correct the operator sets the so-called neutral flame, and experience indicates that the average operator checks the acetylene-gas flow too much and actually develops an oxidising rather than a neutral flame.

READ YOUR PAPER

When you pay the trifling price which is required to be a subscriber to a paper, read it. Read each article in it whether the title suits you or not. You are cheating yourself and not the publisher if you allow any of the material which is at your disposal to go unread. Did you ever hear the story of the boy who was given a Bible by his mother before his departure for college? Well he promised to read it every day. When he returned he told his mother he had kept his promise. She opened the Bible and a ten dollar bill she had placed in it fluttered to the floor, a dead give-away—he had never looked inside the covers or he would have seen the money.

THE FOOLISH MAN SAYS:—

Never bother to turn over an upturned nail. A nail is a small affair, but very effective in producing blood poisoning and lockjaw. It is a shame to discourage the little germ in his efficient programme.

The Manufacture of Light Steel Castings

Practical Experience, Not School Learning, on Production of Steel Castings—Card System Recommended—Dry Sand Work Should Be In Separate Bay—Molding Machines Should Be Used

Read at Birmingham Convention by H. BRADLEY (Sheffield)

IN this paper, which has reference to the practice of light steel castings, any reference to academic or laboratory practice has been purposely omitted. It is dealt with from the author's practical experience of a general jobbing steel foundry, making all classes of steel castings from a few ounces up to 14 tons in the rough, and with metal of carbon content varying from 0.88 to 1 per cent. and over, and additionally in chrome and manganese steels.

The Plan of the Foundry

To run a foundry successfully, the largest output with the minimum amount of handling must be attained. To carry out this successfully, the shop should be planned for the pattern to enter at one end (where there should be shelves or pockets to receive it) and the core boxes with card attached, with works order number, description, and quantity off. The card is ruled at back, so that each day's cast may be entered thereon. When the pattern and core boxes are given to the moulder the card should have the man's check number marked on, together with the date.

When possible there should be a separate bay for dry sand moulds. The work for dry sand should be commenced at the end of the shop, then carried down to the drying ovens, then to the closing and casting floor, where the moulds should be arranged in straight lines, and all runner bushes should be as near one height as possible, so as to avoid hoisting or lowering the ladle. The steel plant should then be fixed as near as convenient, utilizing the floor nearest to it for the green-sand moulds, as these are generally of the lightest section of castings, and, therefore, require the steel when in its most fluid state, to avoid short or faint-run castings.

When the steel is a little on the stiff side it can be used for the thicker section castings. The boxes, after casting, should then pass on a little further to be knocked out and examined, and a note taken of the good and defective castings and recorded on the back of the above-mentioned card. When the job is completed the card should then be handed in to the foundry office, the castings going forward to the cleaning or dressing shop, which should be at right angles to the moulding shop, with tram lines running from one to the other.

The fettling or dressing shop should be equipped with shot-blast plant, oxy-acetylene burning plant, and both circular and band saws, according to size and class of work and output. The castings should then go to the machine shop and despatch shed.

The Making of Castings

The first thing to consider is the pattern making, which depends, firstly, on the quantities of castings required from each. A good wood pattern will withstand the making of 500 castings from it, either by hand or machine. If repetition work is carried out, then either brass or white-metal patterns are necessary, which should be on the machine for small castings. The author prefers the hydraulic machine for boxes up to 24-in. round or square, and for deep-lift pattern the roll-over machine. For anything over 24in. the jarring machine can be used to better advantage.

The difference in making a pattern for machine molding and hand molding is that it is always necessary to fix core-prints to the pattern for the former under any parts that are undercut, as the sand is jarring downwards, therefore, it naturally falls away from the underside of any projecting part.

Tackle.—The boxes should be strong, light, and made of steel. They should all be interchangeable according to the various sizes either for hand or machine. The double lug box is best, giving a truer alignment. The double lug can be either a slot and hole or two holes.

For patterns with small quantities off and intricate joint, a plasted oddside should be made, as they are easy, cheap and durable.

For larger orders or repetition work, machines are a necessity. They do good in two ways, i.e., by reducing costs, and increasing outputs on the jobs they are working. They also speed the work up generally in the shop. Two boys working a machine with boxes 10 in. by 10 in. by 4½ in. have produced 180 complete moulds in the day with from two to four cores in each. Two youths, 17 to 18 years of age, have produced 62 moulds, 18½ in. by 16 in. by 5 in. deep, painted and blacked. The quantities vary according to size of boxes and design of castings. To get the full advantage from the larger machine it is essential there should be an electric crane specially for its use.

For large quantities of light castings the Tropenas vessel or electric furnace are to be recommended.

To ensure sound steel castings it is essential to have in the first place a good steel, that is, steel containing the correct composition for the work required, and properly "killed," in order to ensure it lying quietly in the mould. It is also as essential that the sand be suitable; if being used green, it should have just the correct moisture, and just sufficient bond to work it. Sand, in the first place, should always be dried before milling in order to get the required moisture by adding water, and the necessary binding material. The author prefers to use the natural sands whenever possible. The sands generally used in England for steel castings are Belgian loam, used either by itself or with a small amount of silver sand, Cornish loam with silver sand, and Yorkshire sand with silver sand. Of the three mentioned, the author prefers Yorkshire, as it is easy to work, is tough, but not too close, gives a good skin on either dry or green-moulded castings, and does not cake in the mill as much as the first two. For cores, the author's practice is to mix eight parts of silica to one of Yorkshire and up to 4 to 1 for moulds varying, of course, according to weight and design.

Running and Feeding

Where possible the best system is bottom runners, and in one of the thinner sections of the casting. Careful judgment is required for feeding heads to have the required size and in the right place in order to get a solid casting and avoid wasting steel.

Very soon after casting all runners and feeding heads should be released so as to enable the contraction to take place and avoid having a pull in the casting.

When the pattern is made, it should in the first place be taken into consideration as to whether the casting is to be made green or dry, and the decision generally arrived at is based on how much machining is to be done on the casting, and whether the difference in the two methods of moulding is worth the risk of making an unsound casting by making it in green sand. A further consideration depends upon design of the casting. In such cases it is essential to make it green to allow for the contraction strains taking place and preventing the casting pulling into pieces. In some cases the weight and design must be taken into consideration in deciding these points. If there is no danger of the casting pulling with a dry-sand mould owing to design, it is always much safer to produce a sound casting from dry-sand work than from green-sand work, owing to the properties of the steel used for casting. Of course, there are many different designs of castings to be contended with, and the greatest trouble given to a steel foundry manager is often caused by the designer not having had any steel foundry practice. To produce good, sound steel castings it should always be the aim to have the thickness of the metal as much alike as possible. Wherever thick or bulky pieces of steel are joined together with lighter sections, means have always to be found (if the design cannot be altered) to overcome the difficulties encountered. This can be achieved, either by using chills or causing the thick portion to freeze approximately at the same time as the thinner sections. In some cases, however, a reinforcement is used, but this is not always a wise policy, owing to the possibility of a mishap, after the casting is put to work, disclosing the reinforcement in any fracture. Naturally, the blame would straight away be put down to this method. This can be further illustrated by a large mill pinion casting of, say, 2 ft. 6 in. tooth face by 3 ft. diameter in the tooth portion, reduced down to, say, 18 in. or so on the neck portion. The best method of producing this class of casting is to have it cored out. At times, however, it is found that engineers object to this method of coring out. They state they must have a solid casting. In order to meet their views, as far as possible (which steel founders, of course, have to do), it is endeavoured to produce a solid casting. This, however, is an impossibility without some method of reinforcement, as it is impossible to feed the body portion of the casting of the dimensions mentioned, through the size of the neck and the wobbler. Therefore, the method of reinforcement has to be used. This is accomplished by putting in what is called locally, a "dummy," sufficiently large, to prevent the pipe right through the top neck and wobbler, which would take place unless something of this description was carried out.

Again in the case of hydraulic cylinders, in most steel foundries, there does not seem to be any set way in which to cast them. This is done, either mouth downwards or upwards, but in any case there should be taken into consideration, the location of the large bulk of the steel, and the best means of feeding it. As will be realized, it is necessary to feed all steel castings from the head. In iron foundries, a wrought iron, or mild steel feeding rod is used, and small shanks of metal are poured in time after time until it is set. This method cannot be adopted in a steel foundry, as it would pull out the steel instead of causing it to become more solid as in the case of iron castings.

Another useful illustration is that of locomotive castings. The various parts of these are rather troublesome to make, owing to the varying thicknesses of the strengthening brackets, and it is necessary to give much consideration before starting work, otherwise much trouble is certain to result. These castings, are very often made as light as possible, and thick and thin sections are more usually encountered in this class of casting than in most other classes of work.

The core shop should be self-contained, with special drying ovens, as these play an important part in the making of good castings. The stoves should have facilities for eliminating the moisture as most cores are either made with oil-sands or Bindsandrite, which under the slow baking throws off a lot of steam or moisture. The sand for cores should be very carefully regulated for different classes of work, should be very refractory with just sufficient bond to stamp up to the steel, as there are so many castings which if the core does not collapse very quickly would be wasters; especially in Manganese castings such as tramway points and crossings, owing to the contraction. A machine for making standard cores is a great help, as ordinary standard round cores can be stocked and kept in dry places. Obviously it produces a better core as wooden boxes get out of shape.

Fettling

Cleaning plays a very important part in the costs, and is always a greater speculation than any other process, owing to so many contributory causes. It may be the sand, or the "compo," but generally, in the author's opinion, it is owing to casting at the steel at wrong temperatures. It will be realized that with a ladle of steel, varying from say, 36 cwt. to 56 cwt., it is almost impossible to have sufficient moulds on the floor at one time to take it at varying temperatures to suit all castings. But many of the troubles in this department can certainly be overcome with a good shotblast plant, pneumatic hammers, and swing grinders. There are three methods of removing the feeding heads—burning, sawing, and cutting by the lathe, and obviously the choice will be determined by the design of the casting.

Annealing

It is obvious that the question of annealing depends largely upon the size of the foundry, and output. The best method, in the author's opinion, is the gas fired stove, but for general jobbing work, where all classes have to be dealt with, the movable top is as cheap as any for fairly large quantities. For quick and urgent work, say—where it is required to cast one day and deliver the next—a small handy furnace of about 8 ft. by 5 ft. with a door at the front of the furnace can be built, and operated with lever and balance weight.

In conclusion, there are many other points appertaining to the manufacture of steel castings, but those enumerated should be sufficient to provoke an interesting and profitable discussion.

OXYGEN, HYDROGEN AND CARBON

Oxy-acetylene cutting and welding has become so popular of late that it would seem as though almost everyone understood it, but as a matter of fact there are very few who understand it.

Oxygen and carbon are the two essentials in creating combustion no matter what fuel is being burned. The oxygen in the air and the carbon in the wood-pile or coal pile or whatever is being burned unite and cause fire.

This is precisely what takes place in the oxy-acetylene process. It is what takes place in the Bessemer converter when the oxygen of the air unites with the carbon in the molten iron and burns the carbon out of the iron, heating the iron to a white heat while doing so. In the oxy-acetylene process it is, however, refined material which is being burned.

There are other things besides carbon which will aid combustion when combined with oxygen. For instance hydrogen gas, which combined with oxygen forms water, but when separated from the oxygen is the most inflammable gas known. This gas requires to be in combination with oxygen in order to burn, and before the advent of oxy-acetylene the oxy-hydrogen flame was considered a wonderful achievement, but while it burned with considerable brightness the hydrogen gas was too light a gas to carry much heat. By experimenting it was found that if equal parts of hydrogen and carbon are exposed to an electric current, the carbon would act as poles and the hydro carbonate would be partially burned, forming the gas formerly known as ethine but now universally known as acetylene.

Acetylene gas when used for lighting purposes is a very formidable rival to electric light and if combined with oxygen gas will make a flame, the heat of which will be equally as formidable a competitor with the electric spark.

Oxy-acetylene if forced through a properly shaped torch will make a flame as sharp as a knife and capable of cutting through ponderous chunks of iron. In cutting iron always cut on the side of the piece and cut from the bottom upward so that the metal which is melted will fall away, otherwise it will fill up the groove as fast as it is cut.

These are just a few of the rudiments of acetylene gas working but will serve to set the average man wondering what there is in chemistry. For instance, oxygen and hydrogen, the two most inflammable of gases when mixed in the proportion of hydrogen two parts and oxygen one part form water. This is known in chemistry as H_2O. Mixing these two gases is not an easy task, but it can be done by electricity. When separated they prefer to remain separated. If these same two gases are mixed in equal proportions, which is to say with double the proportion oxygen required in water it forms liquid known as peroxide of hydrogen, a formidable competitor with carbolic acid as a disinfectant but absolutely non-poisonous. Yet these two dry, tasteless, odorless, colorless gases unless mixed by electricity or some similarly effective method to form a liquid will remain in the form of gas and when associated in a proper manner with carbon will form a flame equally as powerful as the electric spark. This is what is known as oxy-acetylene.

Progress of Standardization Work in Canada

Many Industrial Firms Interested—Sectional Committees Formed—Developing a Uniform Product—Benefits of Far-Reaching Character—Domestic Industry Receives First Consideration

By R. J. DURLEY, M.I.C.E., M.E.I.C., Am. Soc. M.E.

STANDARDIZATION work undertaken by the working committees of the C. E. S. A. commenced, in every case, at the request of responsible parties interested. The progress to date has dealt almost exclusively with the preparation of specifications for material or manufactured products rather than with dimensional work.

The main committee has felt that such questions as may arise regarding dimensional standardization in Canada would most frequently deal with the advisability of adopting, possibly in a slightly modified form, standards already agreed upon by bodies undertaking this work in the United States, Great Britain, or elsewhere. In other words, it has not seemed likely that many instances will occur where the work on dimensional standardization can be completely independent of the work done in other countries.

One of the first C.E.S.A. sectional committees to be formed was that on machine parts under the chairmanship of A. R. Goldie, of Goldie & McCulloch, and under this sectional committee there will naturally be organized, from time to time, whatever working committees are needed. There is of course no intention to undertake any action tending to limit the freedom of the designer by insisting on uniformity of design of complete machines. Parts and components used in quantity by all manufacturers of a given line are naturally the object of the association.

The questions so far considered by the sectional committee just named have been matters in which co-operation has been requested by the A.E.S.C. One case of this kind is now before the committee, namely: the proposed American standards for the dimensions of shafting keys. In such a case the American proposals are usually forwarded to us before they are finally adopted in the United States, and we are thus given an opportunity of considering and criticising them and advising how far the proposed dimensions meet the views of Canadian manufacturers.

Quite recently, H. G. Bertram of John Bertram & Sons Co., Dundas, who is a member of Mr. Goldie's committee, has suggested that much useful work might be done by the C.E.S.A. in developing standards for machine tool parts, which have not yet been dealt with in the United States except by firms individually, who have standardized the dimensions of such items as crank handles, machine handles, keys, splines, nuts of various types, taper and cotter pins, oil rings, cap screws, washers and wrenches, for use in their own establishments. Mr. Bertram gives as an example of this, work which has been done by his own firm in conjunction with other firms attached to the Niles-Bement-Pond organization. He believes that if standards of this kind, which have been adopted by individual firms in Canada, were given publicity, so that other manufacturers could compare them with their own, the way would be paved for agreement on dimensions of these parts, covering all firms in Canada engaged, say, in the manufacture of machine tools, or in other branches of machine manufacture, as the case may be.

Economic Importance

It is hardly necessary to enlarge on the economic importance of dimensional work of this kind. Agreement throughout Canada, for example, upon the standard sizes for cap screws, would enable their manufacture in larger quantities, and presumably at a lower cost, so that the sale of a uniform product to a larger number of individual purchasers would be possible. This seems particularly important in a country like Canada where the number of firms engaged in any one industry is not large, and where individual divergencies in practice thus lead to a demand for small quantities of many unnecessary varieties of detail parts to be furnished by outside concerns.

While the influence of the mechanical industry in the United States upon ours must inevitably be very great, it does not seem necessary that we should in all cases wait until dimensional standardization work has been accomplished there. It is often easier for us to obtain agreement among manufacturers in a given industry than would be the case in the same industry in the United States, where the number of divergent views is likely to be so much greater.

Perhaps the most striking example of dimensional standardization can be found in the admirable work of the Society of Automotive Engineers as applied to the automobile industry, and while it is not likely that we shall be able to accomplish anything of so far-reaching a nature, say in the machine tool industry in Canada, there seems no reason why the benefits of dimensional standardization should not be available here to a much greater extent than has hitherto been the case.

The experience of the last two years has shown that standardization work in Canada presents features not only of particular interest but also of special difficulty. While it would appear at first sight that in many instances British or American standards could be adopted without change, owing, in the former case, to the fact of geographical proximity and industrial connection, and in the latter, to the intimate commercial relationship existing, this is not always found to be the case in practice. Differences in industrial conditions and in the class of material and workmanship available, differences in climatic conditions, and in legislative restrictions, tend in many cases to make differences in practice necessary or advisable.

Committees have to bear in mind in framing their requirements that while domestic industry must receive the first consideration, the interests of the purchaser and importer are also affected, since in many branches it is necessary for us to import not only material in a raw or semi-finished condition, but also manufactured machinery or completed engineering products.

Speaking generally, it may be said that as regards dimensional standards, as, for instance, in ball bearings, screw threads, gearing, and the like, American practice is usually followed, and in many cases it may be found desirable to adopt American standards without alteration. In other cases, as, for example, the preparation of specifications for material, the influence of local conditions is often strongly felt, and in such instances specifications of our own, possibly differing from both British and American practice, are being developed. The closest co-operation is, however, being aimed at, both with the British Engineering Standards Association and with the American Engineering Standards Committee, and it is even hoped that in the case of certain British and American Standards it may be possible for the Canadian organizations to assist in bringing about international agreement.

In connection with railway work, the interchange of traffic obviously makes it necessary for Canadian practice to agree substantially with American standards as regards locomotive, car and track work, and our railway bridge specification is in general agreement with a practice adopted by the American Railway Engineering Association. During the past eighteen months the Canadian Association has published among other subjects, specifications for steel railway bridges, for distribution, type transformers for galvanized telegraph and telephone wire, and has in preparation many other important specifications.

The Association is now endeavoring to arouse Dominion-wide interest in the matter of safety codes as affecting public safety in such important connections as elevators, saw-mills, machinery, electrical work, etc., with a view of organizing a thoroughly representative committee and bringing persuasion upon the various provincial governments in

(Continued on page 33)

Methods of Hardening High Speed Steels

No Scaling Takes Place in Salt Bath Practice—Crucibles Have Short Life—Rapid Heating in the Lead Bath—Oil or Gas Fired Semi-Muffled Furnaces Generally Adopted

SALT BATH hardening was first introduced in 1902. Ordinarily, barium chloride is the salt used and the operating temperature is from 2,000 to 2,100 deg. F. (1,093 to 1,149 deg. C.) Graphite crucibles are used for holding the salt, the life of these crucibles being from six to eight heats. The tools to be hardened are immersed in the hot liquid and the tools permitted to remain until the entire mass of the tool has attained the temperature of the bath. These tools are then usually oil-quenched, and drawn to from 400 to 600 deg. F. (204 to 316 deg. C.) in oil, depending upon the kind of tool.

No scaling takes place by this method thus producing a cleaner tool than in muffle furnace hardening, but the method has the following disadvantages: (1) The quenching temperature is too low. (2) Soft scale is sometimes produced. (3) Blistering and pitting sometimes occurs. (4) Pots are very short lived.

It is a well known fact that to obtain the highest degree of red-hardness, partial austenization must take place. This means quenching from a temperature of 2,200 deg. F. (1,204 deg. C.) and upward; indeed, the higher the quenching temperature above 2,200 deg. F. (1,204 deg. C.) up to about 2,350 deg. called "secondary hardening"—the added hardness gained by tempering quenched steel. We have heated small test-pieces of high-speed steel 1½ hours in a barium chloride bath at 2,100 deg. F. (1,149 deg. C.) but the microstructure was the same as when left in the bath just long enough for the heat to soak through.

Blistering and pitting of tools heated in a barium chloride bath are said to be due to particles of the graphite crucible which have broken loose coming in contact with the tools and sticking to them. Sometimes these blisters or beads drop off, leaving pits. The longer service the bath has seen the more loss is suffered through this blistering and pitting.

A graphite pot lasts only from six to eight heats, making this method of hardening quite a costly one. A new salt is now being introduced for the hardening of high speed steel, which can be maintained at a temperature of 2,200 deg. F. (1,204 deg. C.), thus being superior to the barium chloride bath. The container used is a graphite crucible with a cast-steel liner. In this way the steel pot is protected from the flame, and there is no danger of blistering or pitting from particles floating through the bath.

Pack Hardening

Pack hardening consists of packing the high-speed tools with charcoal in a suitable container. The container is then luted carefully with clay, and the whole placed in a furnace, the temperature brought up to around 2,200 deg. F. (1,204 deg. C.) and held there a considerable length of time. Tools are then removed, oil-quenched or air-cooled. This method gives a tool free of scale, but has the following decided disadvantages: (1) Quenching temperature is too low, and (2) tools are carburised. We obtained the temperature of some test-pieces with an optical pyrometer just before they were removed from the pack, and found the temperature to be about 2,050 deg. F. (1,121 deg. C.), although the furnace temperature was 2,200 deg. F. (1,204 deg. C.), and they had remained 1½ hours at heat. Scleroscope tests and micrographs verified this temperature. Furthermore, test pieces showed a gain of 0.40 per cent. carbon on the surface after being given the pack treatment.

I have been informed by two different men who attempted this method that at times the cutting edges of tools melted, due either to the higher carbon content of the surface of the tools or to the tools coming in contact with each other. One other experimenter tried to use a cast-iron box for packing, but as cast iron melts at about 2,200 deg. F. the results can well be imagined. Carborundum powder has been suggested as a substitute for charcoal for a packing material, as the former would not carburize the steel. In the writer's opinion, however, high-speed tools treated in this way would be inferior to tools heated in the semi-muffle furnace, because the steel would have to remain at a high temperature for a long time when pack hardened, thus producing a coarse-grained structure.

A lead bath was tried quite extensively about 10 years ago for heating high-speed tools, but the method did not prove a success. At 2,200 deg. F. the vapor pressure of lead is about 20 mm. of mercury, so that severe volatilization will inevitably ensue. It is also quite a problem to find pots to hold the same. Difficulty is also experienced in controlling the time of immersion, as lead is a very rapid heating medium. A metallurgist for one of the large tool steel mills in England told me recently that a large amount of high-speed steel was hardened in his country by the lead bath treatment. He stated that they were able to obtain a very pure grade of lead and could operate at a temperature of 2,300 deg. F. (1,260 deg. C.). His method for hardening a 1-in. high-speed hand reamer would be to preheat to 1,500 deg. F. (816 deg. C.) in a muffle furnace, then transfer the tool to the lead bath whose temperature was 2,350 deg. F. (1,288 deg. C.,) hold there 15 seconds and cool in an air blast.

Most of the high-speed steel hardened in this country is heated in semi-muffle furnaces, oil or gas fired. It is always advisable to have these furnaces equipped with pyrometers, using Noble metal couples. The optical pyrometer is also satisfactory for controlling these high-temperature furnaces.

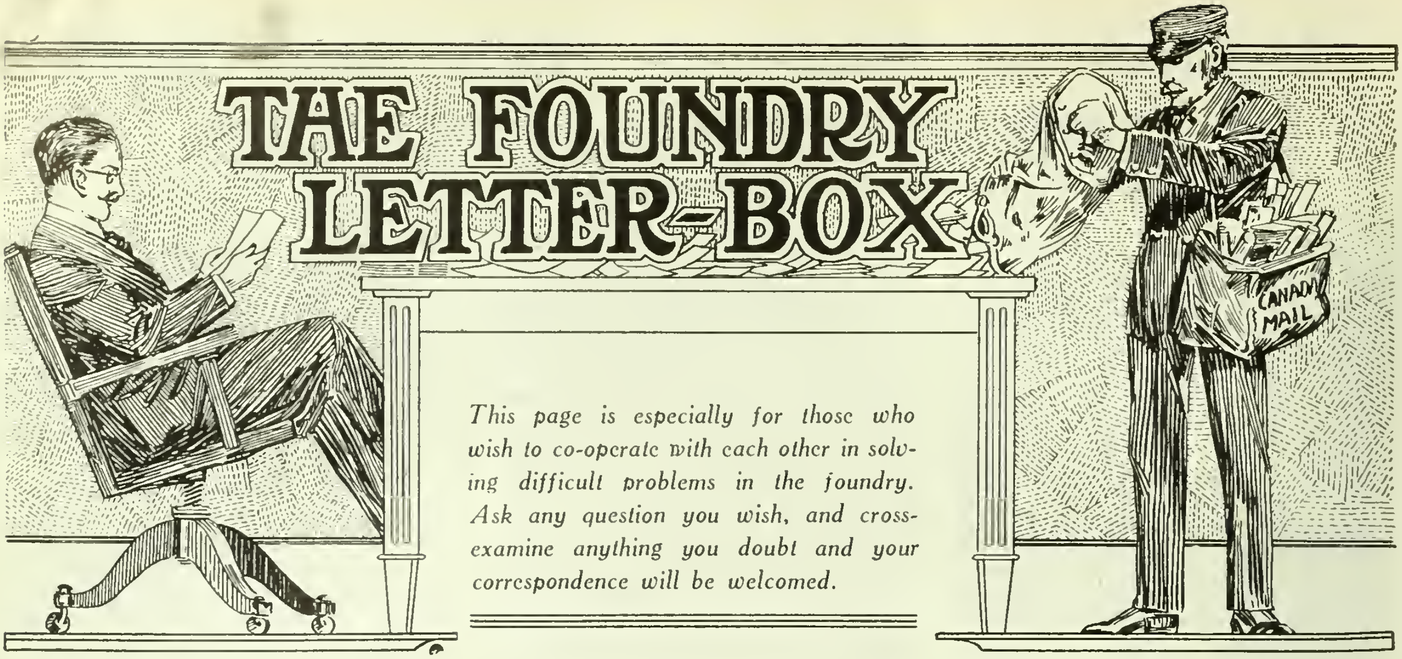
Work to be hardened should be preheated to 1,500 to 1,600 deg. F. (816 to 871 deg. C.), and when thoroughly heated through at this temperature, transferred to the high-temperature furnace, whose temperature is higher than the desired hardening heat. The tool is left in this furnace until the cutting edges have attained the proper temperature—about 2,300 deg. F. (1,260 deg. C.)—and the material then quenched. Soaking at the high temperature is to be avoided, as it coarsens the grain and is likely to "burn" the steel. In such practice the time factor is evidently just as important as the temperature. Quenched tools are then drawn to the desired temperature. One great advantage of this method of hardening is the high temperature attainable, thus producing the greatest degree of red-hardness and almost complete solution of the carbides. The disadvantage is that the tool scales to a degree, which can be reduced to a minimum by a thorough preheating and the proper mixture of fuel and air in firing the high-temperature furnace. Large high-speed tools have been very successfully hardened by using two preheating furnaces; the first is maintained at a temperature of about 1,100 deg. F. (593 deg. C.) and is used as a stock furnace. The temperature of the second preheater is 1,700 to 1,800 deg. F. (927 to 982 deg. C.). The material will not scale in the first preheating furnace; while the steel will oxidize in the second preheater, it requires less time to bring it to heat, thus reducing scaling to the minimum.

PROGRESS OF STANDARDIZATION

(Continued from page 32)

order to unify their requirements and remedy the present unsatisfactory conditions. In this work there is no doubt that the results of the activities of the two American Committees dealing respectively with the National Electric Code and the National Electric Safety Code, will be fully considered and appreciated

Much of the safety code work now being actively pressed forward in the United States is of great interest to Canadian industry and in many cases we have received cordial invitations to co-operate, which have been greatly appreciated.



THE FOUNDRY LETTER-BOX

This page is especially for those who wish to co-operate with each other in solving difficult problems in the foundry. Ask any question you wish, and cross-examine anything you doubt and your correspondence will be welcomed.

KNOWS IT ALL

Editor Canadian Foundryman: We have some pretty smart men in Canada and it might be worth your while to get in touch with them, not with a view to selling them your paper, but with the possibility of getting some advice and information from them. We have men right here in Canada who never read technical papers because there is nothing in them but what they know all about. I was talking a while ago to a Hamilton molder about twenty-five years of age who said that he guessed Canadian Foundryman was all right, but that there was nothing in it but what he knew all about, as he had been right through both iron and brass from beginning to end. He understood mixing all the non-ferrous metals and understood the cupola furnace thoroughly. He also knew all about core making and could mold anything which came along. Of course, I can readily understand that there would not be any occasion for him to read any paper. I was also talking to a man who had charge of a foundry in the Galt district who claimed that he never saw anything in any of the foundry papers but what he had done. He took exception to articles starting off with putting down the follow board and placing the pattern on it and ramming up the drag. He calculated that everybody knew that part of the game, but he did not say where he would like to see the start made, or how he would write an article so that it could be understood without beginning at the point where the molder would begin. I don't think it is possible to learn any trade out of a paper, but I know I have been benefited by reading Canadian Foundryman. I read an article some time ago on how to make a tapered pulley from a straight pattern. I doubt if either of the "thorough foundrymen" which I have just quoted could do it. I know that I could not until I read in your paper how it was done, and now I flatter myself that I believe I could do it. I have read lots of things on how patterns which are not like the casting is to be are used to make the desired article, and while it looks simple enough after once shown, it would bother any one to think up all of these things without the aid of others. It is certainly an ideal way of keeping posted to exchange ideas and experiences in a paper such as you are giving us for mere nothing. I certainly would not be without a paper on my work and I think Canadian Foundryman is all right:—MOLDER WHO DOES NOT KNOW ALL.

* * * *

BE A SUCCESS—NOT A GROUCH

How many successful men do you know? Not very many. Every little hamlet, no matter how small, has its one most important citizen. He may be the general storekeeper and the postmaster combined, but in the absence of any better he is considered as quite a personage. The rest of the community seem to look up to him, but right down in their hearts they are jealous of him. They think he must have had a pull or got a lift, or struck luck, or by some means got an advantage over them, which was no fault of theirs, and nothing to his credit.

In the larger cities of population in the industrial and business world it is rampant. The employee is generally jealous of his employer, while the tenant speaks contemptuously of his landlord. Everybody who is down feels that those who are in better circumstances are righteous targets for his missiles.

A successful man usually gets arrogant and domineering, thus making those who come under his control dislike him, but this is no excuse for the voluntary down-and-outer to form societies and organizations for the avowed purpose of standing in the way of the man who would be successful. A far better method would be to shake off that grouch and be one of the successful fellows. Don't froth at the mouth at the mention of men like Andrew Carnegie. He never could compel anyone to work for him, and anyway he was not worth five cents when he began life in the United States. In fact he was worth less than nothing to the extent of the price of his ticket from his old country home to America, which he had to pay back, after saving it out of what he could earn from such work as he could get to do from strangers, who had never heard of him. On top of this he had no means of earning money excepting as a laborer. Yet we all know him as a financial success.

Working men delight to say that they would not enter a Carnegie library because they are built with money that did not belong to Carnegie, yet they having nothing to back up such a contention. They all had the same chance that he had. Carnegie argued that anyone could be successful if he had sufficient knowledge and would put it to use. He was prepared to furnish the poor uneducated man with the knowledge if the poor uneducated man would do his part by putting forth the necessary effort to make use of the free knowledge. Carnegie's contract with the people who accepted his money to build libraries was that they should be kept supplied with new books each year, to the value of one tenth of the cost of the building, and these books should include every book which any would-be scholar might ask for. By this means it is possible to get whatever is known on any subject free of charge. The drawback to the human race is that there are very few who want to have any worry on their minds, but there are many who are anxious to lay claim to what comes from some one else's worries. There are those who prefer to spend their money as fast as it is earned, and there are those who have a savings account to which they keep adding a little each week. While the latter is by far the best course to pursue it is not much good. A savings account is not much good excepting as a means of accumulating the first few dollars, but a savings account is not an investment; it is just money for some one else to invest. If you will be a success, you must have confidence in yourself to make your own investments. Do not be careless and throw away your savings, but this is not necessary. Bankers have to use judgment in making investments, and they are sometimes slow to see opportunities.

Bankers are in business for the same reason that other merchants are in business—to make money. While other merchants buy and sell commodities of various kinds, the banker buys and sells money. His success, like the merchant's, is dependent upon his ability to buy cheaper than he sells. Your banker buys the use of your savings and pays you three cents a year for each dollar. If you have ten thousand dollars in the bank you will get six dollars per week for the use of it. If you have sixty or seventy thousand dollars in the bank you may have an income big enough to live on, but then you haven't this amount of money and it is doubtful if you have ten thousand. If you have one hundred dollars it is too valuable to let some speculator have for three dollars per year. Your banker pays you three dollars for your hundred and then he invests it. Why don't you invest it and get something on your mind to think about? When a banker is asked for advice regarding an outside investment, it is the most natural thing in the world for him to frown and preach caution. The withdrawal of your funds from the bank for outside investment eliminates the banker from participation in the real earning power of your money. Use your own brains and put your money to work for your own good, and build up industries in Canada. We think we have a great banking system, while the rest of the world is laughing at us with our bank on every corner, gathering up our savings, for others to live on. In 1907 we were suffering from what was known as a financial stringency through our money being loaned to our neighbors, south of us. Yet we were running after the Americans to invest their capital in Canada, when in reality we were asking them to bring over their brains and invest our capital for us while we used our backs and hands. Use your brains and your savings together and the practice which comes to the brain will be a great asset. Those of us who insist on being workers for some one else deserve little in return. Worry is interesting when persisted in, but the man who will not worry, and who does not want to be bothered with the anxieties of a business must content himself with being paid accordingly. It is useless to talk about producers and non-producers if we do not try to elevate ourselves and become interested in business as well as work.

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WANTS MIXTURE FOR GRATES, ETC.

Editor Canadian Foundryman:—We would be much obliged to you for any information regarding best practice followed in grey iron stove foundries, regarding wood and coal grates and fire linings.

We have complaints from some of our customers that the grates and linings of our stoves do not resist to the action of fire as they should and that they are burning too rapidly.

We are pouring these pieces from the run of the cupola together with the other stove parts, without any consideration for heat resistance.

The charges of the cupola averaged as follows:—

575 lbs. No. 1 soft pig iron.
350 lbs. No. 1 machinery scrap.
150 lbs. Sprues & Gates.
13 to 14% Detroit Solvay coke being used.

The average analysis of pig iron is:—
Silicon, 2.65 to 2.75; sulp. 0.03; phos., 0.60; manganese, 0.60 to 0.70.

This gives us good fluid iron, but is it suitable for grates and linings? Is it of general practice in stove foundries to cast grates and linings out of a special iron, as compared with other stove parts?

In this district, it is a common practice to cast grate bars for boilers, out of cheap hard iron and it is accepted by customers as the most suitable.

We wonder if stove grates and linings could be cast with advantages over our soft iron, with this same hard iron and would like to get your advice regarding that matter.

We hope that you will favor us as usual, with elaborate information regarding the general and the best practice followed in casting grates and linings for stoves and we beg to thank you sincerely in advance.

FOUNDRY SUPERINTENDENT.

Answer:—The idea of using cheap, hard iron for grates is certainly incorrect, as it is a well established fact that hard iron melts more easily than soft iron, in the cupola, and it will do the same anywhere else. This, of course, refers to iron which is hardened with sulphur, and this is the kind of hard iron which is usually to be encountered.

Iron of this kind will be short grained and will crack from the heat, thereby aiding in its destruction. The low price would be the only excuse for using hard iron. Your iron, however, is not an ideal mixture for grates or fire backs, although it would be a nice metal to pour. My suggestion would be to make a special mix for the first charge in the cupola and use it for these castings and if necessary it could be used for a number of other parts on a stove. A pig iron which will produce castings containing 2.75 per cent. silicon would carry more scrap than you are using, even for stove plate. The phosphorus while helping the metal to run in thin sections is not good for grates. For this first charge I would suggest 40 per cent. of No. 1 pig and 60 per cent. of machinery scrap and sprues. I would increase the scrap until it analyzed approximately, silicon 2.00; sulphur, 0.05, phosphorus, 0.20; manganese, 0.60. This will make a strong metal which will resist the heat better than the high silicon, high phosphorous iron which you are using, and better than the hard sulphury iron which you propose. A point to be remembered is that grates will always burn out ahead of the rest of the stove and it is quite natural that the purchaser will complain and get new ones free if he can arrange it that way. In most stove foundries the rule is to transfer the first iron from one ladle to the other in order to dry the ladles. This iron will not do for plate but it is all right for fire pots and grates. If this iron is a special mix it will in no way affect the thin plate castings which will be poured afterwards. In the next issue of Canadian Foundryman we will publish a recommended table showing different chemical analyses for different classes of work.

* * * *

OLD METHODS COMPARED WITH MODERN ONES

Editor Canadian Foundryman:—A recent number of your paper dealt with gearing. Reading it made me reminiscent, and recalled some experiences in my early history a half century ago. I was an apprentice in a machine shop doing a general line of work, including mill machinery. An order for a number of spur gears came in. They were about three feet diameter and probably 8″ face. The only accurate dimension I remember is the pitch 2¼″, that being the one giving best results driving mill stones. The reason for remembering that was that I asked why that particular pitch was best. I did not learn. The teeth were chipped and fitted on one face and were laid out by setting dividers at 2¼″, the pitch, and describing an arc on both sides of the pitch circle, the centre being on that line. Everyone familiar with gears knows that was wrong, but no one around there knew better so it went. The vise man said it left a corner at the pitch line that had to be rubbed off. Those gears satisfied the millwright, which shows that people are satisfied with conditions if they don't know of any better.

While these were in process another unfortunate was wearing his life away dressing a bevel gear.

A couple of years later I wandered into a shop making a specialty of mill work and saw gear cutting for the first time. The machine dressed one side only and did the job in less time than was required to lay out by the old method.

Later I had to dress the teeth of a pinion for millstone and when the time came to lay out the teeth I sent for the millwright to get his ideas on the form of teeth. He came, but was unable to determine how to lay them out. On another occasion I had a close call for humiliation. The town was in an uproar over the matter of piston and rotary pumps on fire engines and a public meeting was called to discuss the matter. My end of the performance was to show by models the two systems. The piston model was easy but when I tackled the rotary, which I understood was of the Holly pattern, I discovered that I did not know how to draw a Holly pump, and there was no time to find out. To make a public admission of my ignorance was distasteful—extremely so. The plan I adopted was to make two grooved pulleys, mounted on woodscrews and fitted with a crossed belt. Cardboard discs were fastened to these pulleys and a pencil set at the circumference and another at the pitch on rotation of the discs produced outlines closely resembling the impeller in Holly's pump. As there were more in the audience who knew more about it than I, the plan worked and I saved my reputation.

Your idea in publishing what you did evidently was for the purpose of educating your patternmaking readers in that line.

I have had considerable experience in that line and have found few patternmakers and fewer machinists and draftsmen who know anything about the subject, as it has become a special line.

Where gears are cut the procedure is to order a cutter or form for that particular tooth and put it in the machine. Someone around the shop where the cutter or former is made determines the shape. Or if there is a generating machine even that is dispensed with.

This brings to mind a remark by a college professor that a person who uses tables printed in hand books should be able to calculate them. Most of us know how to find the area or circumference of a circle, but we refer to the table. Some of us know how to calculate a table of logarithms or one of sines, etc., but most of us do not; we know how to use the tables and that answers the purpose.

In conversation some time ago with the local professor of mathematics she admitted her inability to calculate a table of sines. This knowledge is unnecessary to the people who have to dig in and earn a living, therefore, why take the time to learn it? Times change and conditions follow. Much of what was done by hand is done now by machines and the result is a class of workers who have no idea of doing anything the old way. I sometimes wonder how the world will do things when all of us old-timers have passed out, but they will find a way. My memory runs back to the time when not only were gear teeth chipped and filled and flat drills did all in their line, but all the wood work in a building was done by hand. Shavings knee-deep covered the floor and the carpenters were glad to have children with bags and baskets remove the litter. The world struggles on under the new conditions.

I had a talk a few days ago with a molder of the old school and heard his views on squeezer molders. His remarks showed the direction the foundry is moving. The necessity for brains is diminishing.

I had a case once of trouble with molding machines. The foundry foreman, a good politician, asked me to try and find the trouble with his machines, two squeezers. My first move was to get the operator to dig the sand from around it so that I could see what it was like. He did so. I then asked him to show me what was the trouble, and to do so started the machine. There was nothing the matter. The second machine was dug out and found o.k.

There is another point to be considered in this connection. In the old days when hand work was the rule, people lived and some accumulated property out of the savings. Owning his home was common among the workers. I think it was John Stuart Mill who said he could not see that the inventions had benefited mankind. What is the condition of the worker to-day? How does it compare with that of those gone before? The answer is not cheering. But the people have always found a way out and there is reason to expect they will in this case.

JAMES BELL.

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ALUMINUM THE COMING METAL

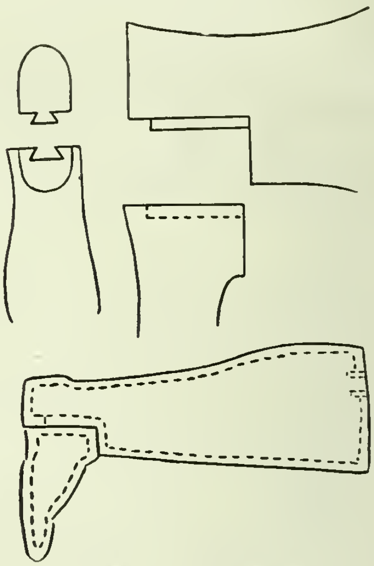
We are in receipt of three letters from three widely separated sections of the country, but all bearing on the one subject. The first is fairly well answered in the last few issues of this paper, but will be fully covered in next issue in which we will show the modern iron pot melting furnace which is considered by most aluminum men to be what is required. The other two questions which seem to be widely different are to all intents and purposes the same, at least the same answer would cover both.

Here are the letters:

In connection with our gray iron foundry, we have been making aluminum castings and melting our metal in cast iron ladles in an ordinary heating furnace. We have now come to the time when we have to get a little more up-to-date, as we have quite a number of aluminum castings to make. We would like to get some information regarding a better way of melting which would not be too expensive to install.

Another one says: — In casting our boot-tree lasts we have had some trouble in casting joint which is made in two chills or dies, like the accompanying sketch, which allows the last (leg part) to be pulled out of boot first, so that toe part may be pulled out afterwards. The difficulty we have had is that the metal will not lie well against these chills or dies. We have tried casting with fine sand stuck on chills with linseed oil, but that method while effective in stopping the shrink holes is too rough for our purpose as the joint must be smooth. In the United States they use some special preparation for coating these chills which is very effective allowing a smooth surface and no shrinkage holes. Could you tell us if you know of any such preparation?

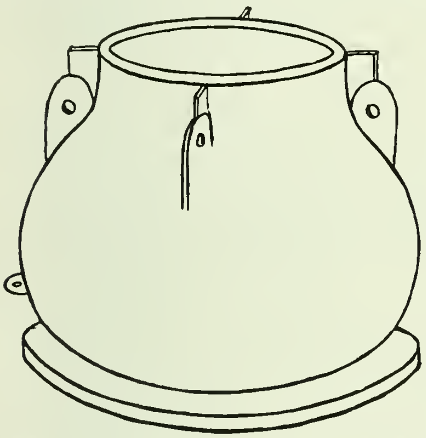
The next one reads as follows:—We are casting aluminum cookers, as per sketch in ordinary green sand moulds —pattern leaving its own core, but find they are costing too much, and would ask you if it is possible to make a cast iron mould in two halves with a sand core and cast in this way, or perhaps a brass cast would do better. We do not want to use cast steel if we can help it. Do you think a cast iron or brass mould would last long? Would it be possible to cast these pots in plaster of paris moulds, and would they last long?



Details of boot-tree last.

The pot weighs about 18 lbs. and is ¼ inch thick, also has some snugs cast on. What would you coat the mold with, and what is the flux for aluminum?

Answer: As I have said, these last two questions would seem to be very little alike, but are really calling for the same answer. The chills are not used for the purpose of setting the casting, so much as to make a finished job which would not be possible in sand. The permanent mold for the kettle is for the purpose of economy. The trouble with all casting propositions is that as soon as the melted metal enters the mold it creates a gas. This applies to every kind of metal and every kind of mold. In sand molds the gas can escape through the sand, but with a metal mold this is not possible. For this reason, if metal is used to form part of the mold, some allowance must be made for the escape of the gas. Years ago when flow mold boards were made of cast iron poured on a chill, the mold was stood on edge before pouring, and the entire top edge was cut through the parting in little grooves which allowed the gas to travel ahead of the metal and escape through these grooves. If something of this kind is not practised, it will be difficult to have the metal lie against a metal surface and make a nice casting. There is no material which can be applied to the face of the mold but what will add to the amount of gas generated. Polished steel works all right if kept polished and pressure used to force the metal into mold. If pressure is not used and it is the intention to pour the molds just the same as sand molds, there is nothing better than brass to make the molds or chills from, as iron corrodes and makes gas, while clean polished brass makes very little gas and does not corrode. There is no particular difficulty in pouring aluminum into a metal mold, providing it is poured rapidly enough to flow over the surface before it sets or cold shuts, and providing the air which is in the mold and the gas which is generated can escape, but if the mold is the least bit corroded the gas cannot escape. One point not to be overlooked is that of shrinkage or contraction. Aluminum poured into a metal mold will shrink and free itself from the mold, but if more than two lugs are cast on the outside it is obvious that they will require to be accurately spaced and tapered so as to allow for contrac-



Aluminum cooker to be made in permanent mold.

tion. I do not believe that plaster of paris would be very permanent.

I have had considerable advice on the possibilities of carborundum for the purpose of permanent molds, but I have no definite knowledge regarding its success. Carborundum is an artificial graphite manufactured by the Carborundum Co., of Niagara Falls, N. Y.

NOTHING VENTURED, NOTHING WON

The best way to get a chance is to take one. Sure things are poor things. When you strike a certainty, you strike limitations. The making of profit almost always means the taking of risk.—
Kauffman

FRESH AIR

Get plenty of fresh air—your lungs feed on it. Your blood is purified by fresh air in your lungs.

Fresh air and cold air may be the same or they may not. Clean fresh air means health.

Introducing

JAMES D. JONES

Superintendent Algoma Steel Corporation Sault Ste. Marie, Ont.

To be general superintendent of a plant such as that of the Algoma Steel Corporation, Sault Ste. Marie, with its blast furnaces, its blooming mills, its rail and structural steel departments and multitudinous other activities, would seem to be a fair sized order for any man, no matter how efficient. But James D. Jones, who fills that position. can find time occasionally to function elsewhere. He impresses one as being young in years, but when he discusses different phases of the steel industry, it is evident he has not lost any time or overlooked much as regards what has been done and what might still be accomplished.

Readers of Canadian Foundryman renew their acquaintance with Mr. Jones whenever the ore resources of Ontario are being considered. At the recent meeting before Hon. Harry Mills, minister of mines, to investigate the feasibility of a native blast furnace industry, Mr. Jones told the metallurgists and mining men present some significant things. He knows from experience just what can be done with the siderite and magnetite ores that predominate in Ontario. The famous Magpie mine was operated for some time by the Algoma Steel Corporation, and it was found that by mixing its siderite ore with magnetite in certain proportions, an ore was procurable at $1.57 cheaper than anything of the same grade from straight American ores. Mr. Jones is an authority on beneficiation and after visiting many important plants in the United States, declares that there are apparently no problems in Canada that are not existing and are being successfully solved in the United States. With proper study of ore conditions, in order to produce desirable grades, and with the development of organization, it is his opinion that a market will be available for all of the Canadian ore that can be produced.

ECONOMIC MINERALS OF CANADA

The subject of Ontario's iron ore deposits in last issue of Canadian Foundryman brings to mind the series of articles which happened a few months ago on the subject of economic minerals of Canada. These articles were quite interesting and covered the ground fairly well, but there were a few things which might have been more thoroughly dealt with. For instance copper is a metal which Canada can produce in large quantities. It was mentioned in these articles, but being a drug on the market at the time, owing to over production during the war, it was probably considered as unworthy. Copper is not such a drug now as it was a year ago, and mines which were not considered as worth working will soon be of value.

A large sum of money has been spent in developing a copper deposit on Copper mountain in southern British Columbia, and in erecting a concentrator. A spur of the railway has been run to the concentrator and mine, and the power line from Bonnington Falls extended to the camp. Mining operations were started in October, 1920, but, owing to the drop in the price of the metal, work was discontinued. There are other smaller mines in British Columbia from which considerable copper is produced.

In Ontario the production of copper has been almost wholly from the nickel-copper deposits of Sudbury district. The ores consist of sulphides of nickel, copper and iron. The amount of copper produced is dependent, therefore, to a great extent, on the market for nickel.

A large sulphide deposit consisting of pyrite with bands of chalcopyrite and zinc blende has been proved on Flinflon lake in northern Manitoba. This is too low grade to be commercial under present conditions of transportation. The copper deposit at Mandy mine not far from the Flinflon deposit was sufficiently rich, however, to permit of profitable exploitation although transportation conditions necessitated a long haul, part way by horse teams, and part may by boats, to The Pas, whence the ore was shipped by rail to the smelter at Trail in southern British Columbia.

Copper ores are also produced to some extent in Quebec and Yukon.

Other Minerals

A number of other minerals are produced, the value of which amounts to a considerable sum in the aggregate. Quartz and quartzite are quarried for metallurgical purposes. Arsenic is a product of the arsenical ores of the Cobalt silver camp. Sand suitable for common glass is found in southern Ontario and Quebec and elsewhere. Antimony ore has been mined in New Brunswick and Nova Scotia. Grindstones, pulpstones, and scythestones are produced in the Maritime Provinces, infusorial earth in Nova Scotia, and corundum in Ontario. Actinolite for the manufacture of roofing is produced in small quantities in Ontario. Iron oxides

(Continued on page 42)

S. S. MOORE, Managing Editor
F. H. BELL, Editor

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Technical Journal Devoted to the Foundry and Metal Industries.

B. G. NEWTON, Manager
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THE MACLEAN PUBLISHING CO., LIMITED, 143-153 UNIVERSITY AVE., TORONTO, CANADA

Good Times Ahead

FRED L. HAM, Editor of Business Bulletin, Chicago, writing in his publication, has many things to say regarding conditions in the United States which are equaly applicable to conditions in Canada. The revival is long overdue in both countries, and while optimism is encouraging it does not count for much, but leaving out optimism and getting down to cold facts the indications are that normal times are right at hand. Here is what Mr. Ham has compiled:—

"Business is better.

"The outlook is excellent.

"Good times loom immediately ahead.

"Analysis of reports from every part of the country gives a definite basis for the foregoing statements. These reports come, as shown by excerpts on the inside pages, from conservative authorities: *Bradstreet's, the Chicago Journal of Commerce, the National Bank of Commerce, New York, Commerce Monthly, Harvard Economic Service, The Analyist, the U. S. Industrial Employment Survey Bulletin, the U. S. Department of Commerce Bulletin, and Moulton's Weekly Analysis.*

"Fundamentally, what is back of this satisfactory business condition as seen by the financial publications? It is this: Business men are making money; their profits are increasing. Such is the affirmative statement of the *Harvard Economic Service* weekly letter of June 3. But what is back of these profits? Take a look at the spread of news heads on the publications of these concerns. Bumper crops; construction in all lines on the increase; steel mills turning down large orders; car loadings at highest peak; retail sales good, and as a result of all these factors a firm basis for trade revival is shown and the outlook is bright.

"Farmers are hopeful and are placing orders for machinery and other supplies. In every big industrial center—New York, Chicago, Minneapolis, San Francisco—buildings of all kinds are being constructed, giving work to thousands who, until recently, had been idle; and this boom in building causes a demand for basic materials such as steel, lumber, cement, sand, etc., thus giving employment to thousands of others who lately have been unemployed. Production in the automobile industry this year has already passed the million mark, and in other industries there is a similar trend upward. Telephone companies are expanding; oil prices are better; and the insurance business, which is more and more coming to be considered a business barometer, shows a net gain of $128,000,000 for 1922. All in all, business may be said to have 'turned the corner' and to be out on a straight road going steadily forward.

"To the man who studies the signs of the times this points to one conclusion: Right now is the time to be on the jump—to develop new business, to make new sales and to qualify for and fill new executive, accounting, sales and office positions—now, when the trend of business is on the move upward—not some distance in the future when the work has settled down to a steady grind and the high peak has again been reached."

All of this fits right into Canadian conditions. With six thousand building permits taken out in Toronto alone, and every other place, large or small, following suit in equal proportion, there is no doubt about this one branch booming, and with the automobile plants doubling their capactiy, there is no doubt about that branch. Everything in Canada is experiencing lively times with the exception of the machine shops and foundries, and these, while much busier than for some time back, are not operating to anything like their normal capacity, but they are shaping themselves for busy times which must follow the lead of the others. These industries were the last to experience the slump and it is only in order that they should be the last to pick up, which we see every reason for beliving is to take place within the next few weeks.

* * * *

Encouraging News

THE MASSEY-HARRIS CO., one of Canada's largest institutions, catering to Canada's largest industry, that of agriculture, has had a very satisfactory season, clearing out quite a bit of stock which had been held over. They are now preparing to close down for two weeks for stock taking and general renovating, after which they will open up with not less than 80 per cent. of their regular staff of men in both their Toronto and Brantford plants. This is far in excess of what they have been doing for three years back.

The blast furnaces of the country which have been running steadily right through the quiet times are taking advantage of the opportunity offered by the difficulty in securing coal and are rebuilding their equipment. The Steel Company of Canada at their Hamilton plant, are not only doing the usual bricking up but are having one of their furnaces entirely rebuilt, which includes a new shell, being built by the John Inglis Company of Toronto.

A great many manufacturers are installing new boiler equipment during the stock taking season, with the result that the boiler shops throughout the country are running night and day, all of which shows the confidence which is enjoyed by everyone in the near-future need of these expensive outlays.

* * * *

The Coal Situation

STRIKES and lockouts are still upsetting the world's chances of getting down to business. Some will sympathize with one faction and some with the other, but there does not seem to be many who make much of an attempt to solve the difficulty from the bottom up. How many are there who have given it a thought that the annual coal miners' strike which has been a regularly looked-for event since the oldest inhabitant can remember, might be engineered by the owners of the mines? The workers know that there is only about half enough work to go around if they stay to work, and they feel more independent by going on strike than they would if they had been laid off. The operators like to have it thus, as it banishes all talk of reduced prices for coal. If both sides would come together in the spring and agree to agree it would be impossible to promise steady work to more than half the number of hands and the balance would have to be dismissed permanently. If those who were retained were given steady employment at a wage which would nicely keep them, there would soon be lots of coal and there would be no excuse for charging more than about half what people are forced to pay. But this is just what the operators do not want. As it is there is no talk about price; get the coal is the only thought. If enough coal could be secured from abroad to do without the American article it might bring both parties to their senses. As it is we may look for small parcels of coal, and another strike next season.

* * * *

Analysis of Brass

CANADIAN Foundryman is in continuous receipt of requests for a good book on brass foundry practice—one which tells the formulae for all the different kinds of brass and bronze, with some sort of a guide to tell which one to use when a certain kind of work comes along. To all such requests we are driven to make the same reply—that such a book is not published.

A book of such a kind might appear all right but if it could be compiled, would be of little use, and would, I am bound to say, be a positive injury to the average foundryman. A good book could, however, be written if sufficient demand existed, but it is doubtful if it would be appreciated. A book to be of any real service should be in the form of a text book such as would be used in a school, and the reader of such a book, if he would be benefited, should put himself in the position of a student, and study each page thoroughly and be sure that he had absorbed it. It would be an interesting study and would not require a very big volume to cover all the essentials. It is not of so much importance to know what formula has been decided upon as the best, as to know why it is the best. The effect which one metal has upon another is mysterious and could never have been ascertained by any other means than by experiment, but what it does once it will always do under the same conditions, and while there is undoubtedly much which has not yet been brought out, what is known is accurately recorded, and this is what should be carefully studied. For instance, tin will harden copper up to a certain point, after which it will soften it. Zinc adds to the strength of copper while making the alloy harder, but this is only true in certain proportions. Other things of importance are to learn the temperature at which each metal will melt, the physical strength and weight of each metal, hardness, etc. These points along with different types of furnace, different kinds of fuel, temperature at which it should be poured and the various other features in connection with a brass foundry could be put in book form and be useful, but to have a book to tell the story without any effort on the part of the reader of it, would only tend to make him less efficient. He would never know what was the matter when anything went wrong, and if the casting were put to certain tests by the customer who bought it, and it was found to be wanting in one of its characteristics, he would not know what to do to overcome the difficulty. A foundryman who does not know all the peculiarities of the different metals might correct one defect while creating another. If a brass foundryman who has not had a sufficient amount of experience to enable him to know, off hand, just what to do, could have at his disposal, a chart of all the metals and their conduct towards each other he should be able to arrive at any result desired. Beginning with the next issue we will have a brass foundry section and will keep our readers posted so they will not require a book on brass foundry practice or analysis.

* * * *

Welcome Letter From David McLain

CANADIAN Foundryman is in receipt of a communication from David McLain of McLain's System, Milwaukee, Wis. dated from Invhcailloch, Loch Lomond, Scotland. There is no one we would rather see summering along the Bonnie banks of Loch Lomond than David McLain, but on the quiet, that is not what he is doing. Dave attended the Foundrymen's convention at Birmingham, in June, and while on that side of the Atlantic he is making good use of his time. He expected to leave Glasgow for Ireland in a few days, thence to Paris, Belgium, Germany and Switzerland, returning to London about Sept. 1st. It is a safe guess that there will be a considerable trail of cupola and semi-steel students in the wake of a trip such as this, as Europeans all know the part that semi-steel played in winning the war, and are enthusiastic to become adepts in the science of producing it.

* * * *

Market Quotations

PIG IRON Per Ton.	
No. 1 Foundry pig, Toronto	$32.65
Gray Forge pig, Pittsburgh	27.76
Lake Superior Charcoal, Chicago	33.15
Standard Low Phos., Philadelphia	30.00
Bessemer, Pittsburgh	26.76
Basic, Valley furnace	25.00
NON-FERROUS METALS Per Cwt.	
Lake Copper	17.25
Electrolytic Copper	17.25
Casting Copper	17.00
Tin	35.50
Zinc	7.50
Lead	7.00
Antimony	7.40
Aluminum	21.00
OLD MATERIAL What Dealers Pay.	
Copper, Light	8.50
Copper, Crucible	11.00
Copper, Heavy	11.00
Copper Wire	11.00
No. 1 machine scrap	9.00
New brass cuttings	6.50
Yellow brass turnings	4.85
Light brass	3.50
Medium brass	4.50
Scrap zinc	4.00
Heavy lead	3.00
Aluminum	11.00
	Per Ton
Boiler plate	9.00
Heavy melting steel	11.00
Axles (wrought iron)	16.00
Rails (scrap)	11.00
Malleable scrap	11.00
No. 1, machinery, cast iron	16.00
Car wheel, scrap	16.00
Wrought pipe, scrap	6.00
Steel axles	15.00
Machine shop turnings	6.00
Stove plate	14.00
Cast boring	6.00

PLATING SUPPLIES Prices per lb.	
Polishing wheels, felt	3.80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	.08
Pumice, ground	.05
Emery glue	.05
Tripoli composition	.08
Crocus composition	.12
Emery composition	.11
Rouge, silver	.16
Rouge, powder, nickel	.38
PLATING CHEMICALS Prices per lb. unless otherwise stated.	
Acid boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, Carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium, sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.30
Zinc chloride, C. P.	.30
Zinc sulphate	.06

The Canadian By-Products Co., has recently been incorporated with a capitalization of $600,000 at Hamilton, Ont., and will begin at once the construction of buildings for the manufacture of fire bricks and other refractories.

Industrial Electric Trucks in Better Demand

After a long period of dull business, a healthier demand for industrial electric trucks and tractors is taking shape, and the outlook for the remainder of the year is more than hopeful.

The A. D. Porter, Mfg. Co., Ltd., is a new organization which has recently been incorporated at Galt, Ont., to do pattern making and certain lines of engineering by Alexander D. Porter, John Sloan and George Hancock. They are capitalized at $40,000.

Belleville reports a new industry, the Bassick Mfg., Co., Chicago, manufacturers of the Alemite system of lubrication. The company is repoted to have five branches in the United States and will establish sales branches in Canadian cities.

The K-T. Foundry, Galt, Ont., which has been operating for a number of years as a general jobbing foundry business, has recently been incorporated as a limited stock company with a capital of $100,000 by James R. Fergusson, David J. Flemming and Arthur D. Ward.

The Preston Woodworking Machinery Co., Preston, Ont., are installing a one thousand pound pneumatic crane in their molding shop in addition to their present crane equipment. This is mainly for drawing difficult patterns and for handling cores before placing them in the oven.

The Empire Brass Foundry, 128 Wellington street, Montreal, have the plans prepared and the contract let for an addition to their plant. W. H. Madigan has the contract for the construction of the buildings, which when completed will be equipped with considerable new machinery.

The Canada Electric Castings Company, Limited, Orillia, Ont., have just completed their new foundry addition which consists of a two-story building of steel and tile, 350 feet in length by 50 feet wide. Their capacity now is 25 tons per day, of steel and iron castings, and 8 tons per day of bronze, brass, and aluminum castings.

The Hamilton Facing Mill Co., Hamilton, Ont., have opened a branch at 48 Abel street, Toronto, where they will carry a full line of foundry supplies and facings for immediate delivery. Mr. J. C. Wilkinson, who is an expert foundryman in every branch, and who is well acquainted in the Toronto district, is in charge.

The Canada Car Plant at Amherst, N. S., is busy on an order for 2,500 car wheels for the Canadian National Railway, and one for 100 wheels for the Canadian Pacific. The company is preparing to run its foundry to capacity as it is confidently believed that other orders will be waiting when these are completed.

The Joliette Steel Co., manufacturers of steel castings, Joliette, P.Q., have sold their plant and business to the Joliette Steel Products, Limited, who will continue to operate it, but on a much larger scale, on account of having specialties of their own in addition to the run of work which was done by the former company.

The Wabana Iron Mines, Newfoundland, are rushed with business. Twelve steamers are engaged in the export of iron ore to Germany, via Rotterdam. It is stated at the Sydney headquarters of the British Empire Steel Corporation that three quarters of a million tons will have been shipped by the end of the month, all of which is being paid for in English money.

John H. Eastham, formerly with the Port Arthur Shipbuilding Co., but lately with the Salem Iron Foundry Co., Salem, Mass., has taken the position of Foundry superintendent with the Sidney C. McLouth Foundry, Marine City, Michigan. Mr. Eastham was formerly a valued contributor to the editorial pages of Canadian Foundryman.

The North American Graphite Co. with head office at Toronto, have taken over the mills and mining property at Buckingham, Quebec and will go extensively into the manufacture of crucible graphite and other graphite specialties. It may not be generally known that the different graphite mines of Canada constitute the world's greatest source of supply for this material.

The British Empire Steel Corporation are preparing to blow in a second blast furnace at their Sydney, N. S. plant. This furnace will make pig iron for foundry purposes, since a good market for this kind of iron is now assured on account of the marked improvement in the demand during the last few weeks. A battery of ninety coke ovens are in readiness to be put into operation if labor does not create an obstacle.

The Galt Malleable Iron Works, Galt, Ont., was damaged by fire to the extent of several thousand dollars on the morning of Aug. 7th. The damages, however, are confined entirely to the annealing room and will not in any way interfere with the operation of the plant or the output of castings, as none of the employees will be laid off, and annealing ovens can be operated under temporary covers until the rebuilding operations are completed. These were begun as soon as the conflagration was extinguished.

The Dominion Wheel Foundries, Limited, 131 Eastern Avenue, Toronto, are making extensive alterations to their foundry buildings, partly to beautify their exterior appearance, and partly to make them more comfortable for the men. The street wall has been removed and a new front put in its place which, when completed, will be a modern foundry in every respect, and will be in readiness for the busy times which are anticipated. The building operations are in no way interfering with the regular operations of the plant, which is running right along.

BOOK REVIEWS

Foundrywork, by Ben Shaw and James Edgar, published and for sale by Sir Isaac Pitman & Sons, Ltd., 70 Bond street, Toronto, Ont. Price $1.00. A neat book 4½x7 inches. 120 pages, 60 illustrations and diagrams. A practical treatment of the fundamental principles of foundrywork for engineers, draftsmen, apprentices, and students, describing the tools, materials and practice of iron and brass foundries with examples from practice. The low cost of this book will appeal to those who do not want to tie up a lot of money, while the scope of the subjects covered makes it a valuable assistant to anyone in the foundry business.

Pattern Making, also written by Ben Shaw and James Edgar and published by Sir Isaac Pitman & Sons, 70 Bond street, Toronto, is a book of 120 pages, 4½x7 inches with 120 illustrations and diagrams. It is a practical treatise describing pattern making methods and appliances with numerous examples from practice. It advocates working from reasons rather than from following set rules, and the contents show how to reason out the best method according to kind of pattern to be made. Price $1.00.

CATALOGUES

Unique and attractive best describes the new folder just issued by The Van Dorn & Dutton Co., Gear Manufacturers, Cleveland, Ohio.

It is entitled "Bringing the Van Dorn Plant Home to You."

The cover portrays a mailman with the plant in his arms delivering it to the addressee. The inside is a complete story, profusely illustrated, of the entire "Van Dorn" plant, department after department, just as one would see it on an inspection trip or following the various operations necessary in the manufacture of gears. It is very interesting and instructive. A copy will be sent to any interested party.

Wheelbarrows, road scrapers, trucks, etc.. are described in a neat and attractive manner in the thirty-paged catalogue No. 11, being distributed by Meaford Steel Products, Limited, of Meaford, Ont. Some of the products of this concern are for the especial use of contractors, but the barrows and trucks are of particular interest to foundrymen. Pig iron barrows, charging barrows and sand barrows are among the ones illustrated. All the parts are shown in detail, which together with tables of dimensions makes the book an interesting addition to the foundry library.

NEW FOUNDRY AT PORT COLBORNE TAKES OFF FIRST HEAT

The Port Colborne Foundry Company Limited has been incorporated under the Ontario Companies Act, and has received letters patent constituting them a body corporate and politic for the due carrying out of the undertaking to carry on a general foundry business, and to manufacture every description of iron and steel and other metal work and to deal in the same and to do a general business in iron and metal founding.

The Company is capitalized at $40,000, divided into four hundred shares of one hundred dollars each, with a paid up capital of $8,500. The charter was issued to A. D. Cross, Dave Alair, W. H. Anderson, George Hall and Albert Francis, who have since held a meeting and appointed A. D. Cross president, W. H. Anderson vice-president, and Dave Alair secretary-treasurer and manager. The stockholders are the above three with Mr. Geo. Hall, contractor, Dunnville, Mr. Ernest Gill and A. Francis, Port Colborne.

These men who have had the courage to invest their money in the foundry deserve the support of those who are in a position to give them business. The men who will have the direct oversight of the work will be the president, manager and superintendent.

The president, Mr. A. D. Cross, is well known throughout the County of Welland, a man who has travelled extensively in his younger days, who has the past number of years been in business in Port Colborne and has earned for himself the respect of all for his honesty and square dealing. He has spent a number of years in municipal life. being mayor of the town for the past three years. Dave Alair who has been made manager and sec.-treas. of the company has lived in Port Colborne for more than ten years; for six and a half years of that time he has been particularly before the public, serving as town clerk and treas., and has proved himself both honest and efficient. Mr. A. Francis who will superintend the moulding has had a wide experience as a moulder, having given nearly his whole life to the trade, working in Toronto and Edmonton before the war. When the great demand was made in the old land for shells and other castings to carry on at the front, Mr. Francis with true English loyalty volunteered for service with the British Government. When peace was declared he returned to Toronto and later went to Dunnville as supt. for the J. H. Charles Co., which foundry was closed last July. While working in England on war work, he gained valuable information on mixing metals.

The company has purchased three and a fifth acres of the industrial site from the Town of Port Colborne, they have been busy during the last few weeks installing the equipment and finally ran off the first heat on Monday, August 7th. The foundry will supply a long-felt want, particularly in supplying castings to the industries in Port Colborne, and being situated where the pig iron is manufactured will be a decided advantage in the matter of freight. Workmanship being equal the price of production counts in the present day competition. The foundry is starting with a small staff, but when business warrants it is the intention to employ thirty hands.

ENCOURAGING PROSPECTS AT WELLAND

The Electric Steel and Metal Co. of Welland have an option of $50,000 on the local fair grounds which adjoin their present plant, and there is a good prospect that they will soon start operations.

The Canadian Atlas Crucible Co., are operating full time, while the Canadian Foundries and Forgings find business considerably improved.

A Mr. Raleigh of Pittsburgh, was in the city a few days ago in connection with an effort to take over the business of the Seamless Steel Tube Co. He proposes to make the Lackawanna Tube and also a wire cone, which is used in electric stoves. There is also a strong likelihood of a British cutlery firm locating in Welland. They have a million dollars capital, and already have money on deposit here to start operations.

WANTS INFORMATION ON SILVER PLATING

Question.—Having recently installed mechanical plating barrels for nickeling small parts in large quantities we have experienced considerable difficulty in producing satisfactory results from the method, the solution is a special one and is supposed to yield a very bright deposit of nickel in less time than the ordinary nickel solution. It can be used in still tanks but is particularly adapted to barrel plating. Our results are disappointing and the deposit is very dark and apparently very thin. Can you furnish us with any information which may assist us in getting better plating with fewer failures?

Answer.—We infer from the drift of your letter that you are endeavoring to operate several plating barrels with inexperienced men, and it is evident that you have been induced to purchase a material for preparation of the baths which is unfit for the purpose. Bright plating salts are intended for still plating solutions, and are practicable only on small cheap brass goods which require only a thing coating. All plating solutions which deposit bright plates are very liable to prove troublesome when operated for heavy deposits or as mechanically agitated baths. This is particularly true of bright plating nickel solutions. A nickel solution for barrel plating on iron or steel should be made of double nickel salts with a a small proportion of single salts and just sufficient boric acid to prevent the formation of a green slime upon the anodes and surface of the solution. A formula which has given excellent satisfaction for several years is as follows: double nickel salts, 12 oz; single nickel salts, 4 oz; boric acid, 1 oz; water 1 gallon. If the quantity of goods plated at one time equals 6 quarts, use at least 75 amperes at 5 volts. If the articles are small, quite uniform in size, and regular in shape, operate the barrel at 25 revs. per min. for good luster. If heavy desposit is required and a white finish, reduce the speed to about 4 revs. per min. Dark deposits often result from alkaline solutions or too low voltage. Be sure all connections are perfect; solder them where possible. Large light-weight pieces will necessitate a few trials before perfect results are obtained.

USE THE OTHER FELLOW RIGHT

The golden rule is mightier than many creeds. Practise it in your everyday life, in the home, in the office and in the shop. Do unto others as you would have others do unto you. If practiced in sincerity there would be no labor disputes, no strikes, and no lockouts.

TAKES OVER GRAPHITE PROPERTY

The North American Graphite Co., who have taken over the graphite mines at Buckingham, Quebec, are remodeling the mill and increasing the capacity to one hundred tons of ore per day. They have 425 acres of the best developed mining property in Canada with ore running 15 per cent. pure graphite, suitable for the manufacture of crucibles. This graphite is well known the world over and has passed right along for Ceylon plumbago. Practically the entire output of the new mills is sold in advance, mostly to United States concerns. Mr. H. J. Dingman is president of the new company, and Mr. P. H. Brumell is the general manager.

STEEL INDUSTRY FOR B. C.

British Columbia legislature will encourage the establishment of a steel industry in that province. The announcement was made following a Cabinet meeting, to representatives of the Coast Range Steel Company, a $15,000,000 corporation organized a year ago, under H. X. Landahl. According to the announcement, the provincial government will unite with the Imperial and Canadian governments and guarantee as its share, bonds not to exceed $4,000,000. Under plans which have been discussed by the steel people with the British Columbia government and the facilities committee of the Imperial Board of Trade, the total investment in the plant will run to $12,000,000 for the production ultimately of 120,000 tons of finished steel.

ANCIENT MINERAL IN NEW USES

Mica was familiar to us in our boyhood days in the windows of the heating stoves. It is a mineral, or we should say it is a common name for a series of minerals—for there is a variety of micas—which was known to the Hindus in ancient times. This odd, heat resisting, transparent mineral was regarded as endowed with extraordinary properties by natives.

Hindu writers believed the crystals to be the remains of lightning flashes, from which sparks had emanated and become preserved in the ground.

To-day mica is one of the most important materials used in the electrical industry. Large quantities are found in the United States, particularly in North Carolina, New Hampshire, Virginia and New Mexico. It is found in several forms, but the one that is most important is called muscovite. It is also known as muscovy glass, from the fact that it was used so largely for windows in the place of glass in Russia. Many call mica isinglass, but this is a misnomer. Isinglass is the name given to fish glue, a glue obtained by boiling fish bladders.

Canada, India and the United States produce about 97 per cent. of the entire mica output of the world. India produces about 65 per cent. and the United States about 15 per cent.

Frequently the mica is colored a golden yellow or a grayish white, due to the presence of other metals mixed with it, and the prospector has often been fooled into thinking that he had found a gold or silver deposit. The peculiar property of mica in splitting into sheets is the means of ascertaining its difference from real gold and silver ore, and is likewise responsible for most of its uses in industry.

Mica is easily mined and there is no difficulty encountered in preparing it for market. All loose dirt is removed, and the mica is split into sheets of the proper size. Sometimes single crystals of mica weighing as much as a ton are obtained from the mines. The mica is of various grades and colors. Some fine grades of mica have been used by native Indian artists as canvas for paintings. The ruby or green shades of mica are desirable for decorative purposes.

Mica resists heat. That is why it was used in the old fashioned heating stoves. It also possesses a high electrical resistance and is an excellent insulator. These two properties and the ease with which it is worked have made it important material in the manufacture of electrical machines and devices. All sorts of electrical appliances, such as the telephone, the electric iron, electric heater and the electric light socket, have mica in their makeup. Mica is also used in making lamp chimneys, shades for gas mantles and lantern slides.

Its resistance to shock makes it useful in making motor goggles, spectacles, divers' helmets, compass cards, windows in conning towers on warships, where its transparency is of paramount importance. It is used in making phonographs and loud speakers on wireless installations, due to the fact that it will transmit sound very well. It has been used in India as a dressing for wounds and for many ornamental purposes.

Ground mica can be mixed with paint, made into ornamental tiles and concrete. The ground product has been used to make explosives, as a lubricant for wooden bearings and mixed with oil for metal bearings.

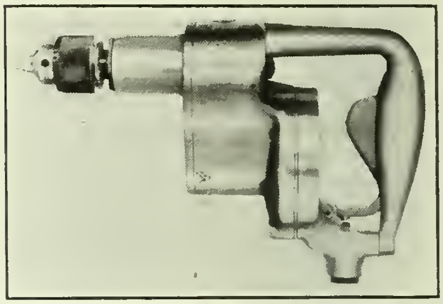
ECONOMIC MINERALS OF CANADA

(Continued from page 37)

come from Quebec. Small manganese deposits occur in Nova Scotia, New Brunswick, and British Columbia. Magnesium sulphate is obtained as a natural product in small lakes of British Columbia. The mineral-water industry is established. There are extensive peat bogs in the eastern half of the country. Native mercury and cinnabar are found in British Columbia and cinnabar deposits were exploited a number of years ago. Strontium minerals are also found. The mining of apatite was carried on a number of years ago, but the discovery of large deposits of phosphate in the United States that could be more cheaply worked led to a great curtailment in the mining of this mineral in Canada. As apatite is frequently associated with mica it is now obtained in small quantities as a by-product in the mining of mica. An increasing interest is being shown in the possibilities of the bituminous shales of New Brunswick, Nova Scotia, and eastern Saskatchewan, and the bituminous sands of northern Alberta.

TINY TURBINE DRILL

A specially designed light-weight yet well-balanced and powerful air drill has just been placed on the market. The propelling portion of this tool is a turbine similar in character to some of the well-known turbines at present on the market, therefore, it is not an experiment. The turbine is made from an aluminum magnesium alloy having the strength of mild steel with about one-third of the weight. The speed of the



Lightweight Turbine Drill.

turbine being high, a gear reduction of considerable amount is necessary, likewise the stresses on the gears are fairly high to meet these conditions, and insure long life. All gears and shafts are made from high carbon chrome nickel steel, oil treated, to insure the maximum physical ability. The tool is ball bearing throughout, thus reducing frictional losses to a minimum. All ball bearings are of the highest quality. The housing of this tool is made from an aluminum alloy, highly finished, and the tool is pleasing and sturdy in appearance.

A special care has been exercised in its design relative to that member which contain the nozzles, so as to permit of easy cleaning of dirt or any foreign matter which may become lodged in the nozzles. The lubrication of the tool is accomplished by having all bearings and gears in one housing, using an especial semi-liquid lubricant which is sufficient for from three to six months' use, depending upon the total actual working time. This drill has a capacity of 5/16 in. in steel and ⅜ in. in wood, and is equipped with Jacobs chuck, and weighs 6 lbs. complete. It is manufactured by The Turbine Air Tool Co., Cleveland, Ohio.

SUCCESS

He, only, who has the vision to realize a real opportunity when it is presented to him, and then has the courage to grasp it, is the man who will succeed. Have you the courage?

Means Better Facings at Less Cost

A Specialized Product

Practically all the raw material for high-grade Foundry Facings is secured from Ceylon. The Hamilton Facing Mill imports direct and grinds in Canada this raw material. We are thus able to offer to the foundrymen of Canada the best facings at the lowest price.

Hamilton Facings will not run before the iron; burn, or brush off the mold. If our facings are not all we claim they may be returned at our expense. Quality, service, uniformity, and dependability are combined in every barrel—and every barrel carries with it our guarantee.

Thirty years of specialized effort taught us, among other things, that high quality, uniformity and variety are essentials—that they should come before anything else—that they are the basis of all repeat orders. The adoption of this policy has made many friends for us in Canada and makes it possible for us to guarantee that we have a grade for every requirement and that every barrel is of uniform high quality.

Foundry Supplies of all Kinds Ready to Ship

When you are in need of high-grade Plumbago, Stoveplate Facings, Core Wash, Charcoal, Parting, Core Compound (either Dry or Liquid), Riddles, Bellows, Brushes, Fire Clay, Cruicibles, Ladles, Molding Flasks, Rammers, and other requisites for the foundry, we can supply you quickly and at moderate cost.

THE HAMILTON LINE

Climax Yellow Core Compound
Climax Brass Flux
Bell's Core Gum
Graphite Boiler Compound
Climax Partine
Climax Black Core Compound
Climax Grey Core Compound
Faultless Blacking
Climax Core Wash
Mineral Facing
Pipe Blacking
Seacoal
XXX Ceylon
XX Ceylon
No. 206 Ceylon
Climax Silver Lead
Imperial Plumbago
Climax Stove Plate Facing

The Hamilton Facing Mill Co., Limited

Head Office and Mills

Hamilton, Ontario, Canada

CLASSIFIED ADVERTISEMENTS

TWO CENTS A WORD, including the "Canadian Foundryman" box numbers; minimum charge is $1.00 per insertion, for 50 words or less, set in 6 point type. Each figure counts as a word. Display ads., or ads. set in border, are at card rates.

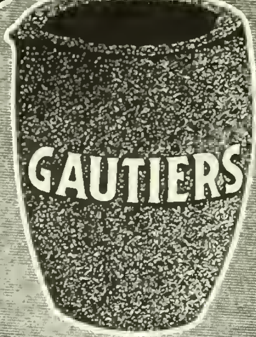
POSITION WANTED

BRASS FINISHER, GOOD ALL ROUND MAN, lathe and bench hand, plain pattern making, good knowledge of polishing and plating. At liberty July. Go anywhere. Box 704 Canadian Foundryman.

PRACTICAL FOUNDRYMAN, 25 YEARS ON light, medium, and heavy work, green and dry sand. Bench, floor and machine molding. Melt by analysis and thoroughly competent on Cupola practice. Good reference. Box 707, Canadian Foundryman. (C.3F.)

POSITION WANTED BY FOUNDRY Foreman, 25 years practical experience on Stove, Furnace, Boiler Sections. Match Plates, and Moulding Machines. Capable of figuring costs. McLain graduate, presently employed but desires change. Address Box 706 Canadian Foundryman.

THE STANDARD IN CRUCIBLES



Manufactured For Over 50 Years

J. H. Gautier & Co.

JERSEY CITY, N.J. U.S.A.

FOR SALE

BARGAIN IN USED ELECTRIC FURNACE — A one-ton Volta Electric Furnace for melting steel, grey iron or Ferro alloy furnace, 220 volts, 25 cycle, 3 phase; complete equipment. For further particulars write Hiram Walker & Sons, Metal Products, Limited, Walkerville, Ont., P.O Box 156. (c.t.f.f.)

WANTED

WANTED—A TABOR MOLDING MACHINE squeezer No. 10—34" between upright, to be in A1 condition. State price. Apply W. J. Dalgleish, 221 Dundas St., Galt, Ont.

J. & J. TAYLOR'S SAFES FOR SALE

One J. & J. Taylor Safe, inside dimensions 15 inches deep, 2 feet 6 inches wide, three feet 11½ inches high and fitted with a built in compartment. Price $250.00.

One J. & J. Taylor Safe 18 inches deep, two feet 9 inches wide, four feet 5 inches high, fitted with a steel compartment. Both safes are in good condition and can be bought at a price that will save considerable money to the purchaser. Price $200.00. Box 900, Canadian Foundryman. 153 University Avenue.

STEEL

Steel Ladles, Shanks, Flask Bands, Tote Boxes, Shop Barrels, Heavy Plate Tanks, Oily Waste Cans, Air Receivers, Smoke Stacks. Write For New Catalogue

THE STEEL TROUGH & MACHINE CO. LTD. TWEED - ONT.

CLOSING TIME

Advertisements for this section must be in our hands on the 9th of each month.

In order that the announcements of your wants, etc., shall not be delayed, please try to have them in our office as early as possible.

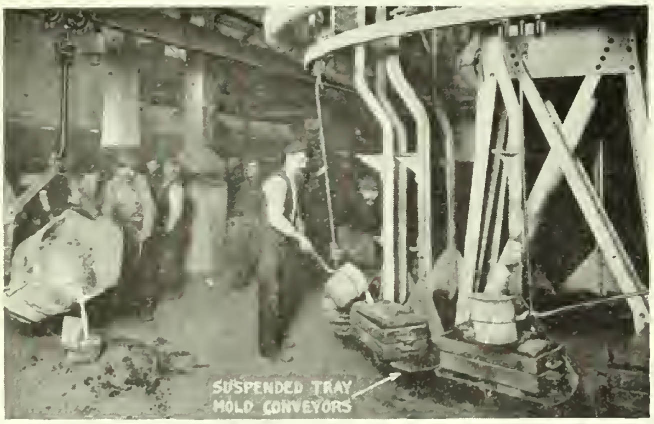
CANADIAN FOUNDRYMAN

Bailey & Bell Fire Brick Co.

Manufacturers and Importers of High Grade Fire Brick, Fire Clay and General Supplies. Special Shapes, Cupola Block, Stoker Brick, Boiler Tiles, Stove and Quebec Heater Linings.

MADE IN CANADA

1347-49-51 Dufferin St., Toronto, Phone Ken. 4335



SYSTEMATIZE PRODUCTION WITH LINK-BELT CONVEYORS

EVERY foundry doing repetitive work to-day should take advantage of the opportunity of making savings, both in production, and in the first cost of the plant itself, by adopting the continuous production system, in a greater or less degree.

There is scarcely a foundry of any kind that does not afford chances for increasing its profits by the use of Link-Belt machinery, which has been developed particularly for foundry use.

Let our engineers look over your conditions with a view to suggesting where economies can be made and production increased. Also send for our book No. 490. It shows many Link-Belt foundry installations of interest to you.

CANADIAN LINK-BELT CO., LTD. TORONTO AND MONTREAL

LINK-BELT

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ANODES, BRASS, COPPER, NICKEL AND ZINC
W. W. Wells, Toronto, Ont.

ARGON
Dominion Oxygen Co., Toronto, Ont.

BRASS FURNACES
Hawley Down Shaft Furnace Co., Easton, Pa.

CHEMISTS
Charles C. Kawin, Chicago, Ill.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Indiana

CORE MACHINES
American Foundry Equipment Co., New York City.

CORE OVENS
Damp Bros., Mfg. Co., Toronto, Ontario.
Monarch Engineering Mfg. Co., Baltimore, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.

CORE PLATES
Damp Bros., Mfg. Co., Toronto, Ont.

CORE SAND
Benson & Patterson, Stamford, Ont.
George F. Pettinos, Philadelphia, Pa.

CRANES
Northern Crane Works, Ltd., Walkerville, Ont.

CRUCIBLES
Joseph Dixon Crucible Co., Jersey City, N. Y.
J. H. Gautier & Co. Jersey City, N. Y.

CUPOLAS
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.

CUPOLA LININGS
Whitehead Bros., Buffalo N. Y.

DUST ARRESTERS
W. W. Sly Mfg. Co., Cleveland, Ohio.

EDUCATIONALISTS
McLain's System Inc., Milwaukee, Wis.

ELECTRIC RIDDLES
Great Western Mfg. Co., Leavenworth, Kansas.
Preston Woodworking Co., Preston, Ont.

FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FIRE BRICK
Bailey & Bell Firebrick Co., Toronto, Ont.

FLASKS, SNAP
American Foundry Equipment Co., New York City.

FLASKS, STEEL
American Foundry Equipment Co., New York City.

FLUXES, IRON, BRASS, ALUMINUM, COPPER
Basic Mineral Co., Pittsburgh, Pa

Directory of Foundry Supply Houses

The Buyers' Directory of Canadian Foundryman was originally intended to contain information regarding lines in the production of which the advertisers actually specialized. We now carry the advertising of leading supply houses, some of whom represent scores of manufacturers, in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the supply houses so we recommend that for all general requirements our subscribers communicate with the supply houses listed below:

The Hamilton Facing Mill Co., Limited, Hamilton, Ont.

Frederic B. Stevens, Windsor, Ont.

The E. J. Woodison Company, Limited, Toronto, Ontario; Montreal, Que.

GRIT AND SHOT, SAND-BLAST
Pangborn Corp. Hagerstown, Md.

LADLES
Damp Bros., Mfg. Co., Toronto, Ont.

LADLE SHANKS
Damp Bros., Mfg. Co., Toronto, Ont.

MAGNETS
Dings Magnetic Separator Co., Milwaukee, Wis.

FLUOR SPAR
Basic Mineral Co., Pittsburgh, Pa.

FOUNDRY ENGINEERS
Austen Company, Cleveland, Ohio.
Charles C. Kawin, Chicago, Ill.
H. M. Lane Co., Detroit, Mich.
McLain's System Inc., Milwaukee, Wis.

FURNACES, OIL
Hawley Down Draft Furnace, Easton, Pa.
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES, GAS
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES COKE
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES ELECTRIC
Pittsburgh Electric Furnace Corp., Pittsburgh, Pa.
Electric Furnace Co., Salem, Ohio.

GRINDERS, PORTABLE
A. W. Sainsbury, Ltd.
Cleveland Pneumatic Tool Co., Toronto, Ont.

GRINDERS, SWINGING
A. W. Sainsbury Ltd., Sheffield, Eng.

HEATERS
E. J. Woodison & Co., Toronto.

HOSE COUPLINGS
Cleveland Pneumatic Tool Co., Toronto, Ont.

INDUSTRIAL ENGINEERS
H. M. Lane Co., Detroit, Mich.

IRON CEMENT
Smooth-On Mfg. Co., Jersey City, N.J.

KAOLIN
Whitehead Bros., Buffalo N. Y.

MAGNETIC SEPARATORS
Dings Magnetic Separator Co., Milwaukee, Wis.

METALLURGISTS
McLain's System Inc., Milwaukee, Wis.
Charles C. Kawin, Chicago, Ill.

METAL PATTERNS
Bryant Pattern Works, Windsor, Ont.
Hamilton Pattern Wks., Toronto, Ont.

MOLDING MACHINES
American Foundry Equipment Co., New York City.
Benson & Patterson, Stamford, Ont.
Herman Pneumatic Tool Co., Pittsburgh, Pa.
Tabor Mfg. Co., Philadelphia, Pa.

MOLDING SANDS
Whitehead Bros., Buffalo N. Y.
Benson & Patterson, Stamford, Ont.
Geo. F. Pettinos, Philadelphia, Pa.
Venango Sand Co., Franklyn, Pa.

OXYGEN
Dominion Oxygen Co., Toronto, Ont.

PATTERN MAKERS
Bryant Pattern Works, Windsor, Ont.
Hamilton Pattern Wks, Toronto, Ont.

PIG IRON
A. C. Leslie & Co., Ltd., Montreal.
Steel Co., of Canada, Hamilton, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto, Ont.

PULLEYS
Dings Magnetic Separator Co., Milwaukee, Wis.

RIDDLES
Great Western Mfg. Co., Leavenworth, Kansas.
The Preston Woodworking Machine Co., Preston, Ont.

SAND
Benson & Patterson, Stamford, Ont.
George F. Pettinos, Philadelphia, Pa.
Venango Sand Co., Franklyn, Pa.
Whitehead Bros., Buffalo N. Y.

SAND CUTTING MACHINES
American Foundry Equipment Co., New York City.
H. L. Wadsworth, Cleveland, Ohio.

SAND MIXERS
Philips & McLaren Co., Pittsburgh, Pa.
National Engineering Co., Chicago, Ill.

SAND SIFTERS
Great Western Mfg. Co., Leavenworth, Kansas.
National Engineering Co., Chicago.
The Preston Woodworking Machine Co., Preston, Ont.

SAND BLAST HELMETS
Pulmosan Safety Equip. Co. Brooklyn,

SAND BLAST MACHINERY
American Foundry Equipment Co., New York City.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.

SAND MULLERS
National Engineering Co., Chicago, Ill.

SAND BLAST ABRASIVES
George F. Pettinos, Philadelphia, Pa.
Globe Iron-Crush & Shot Company, Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND RAMMERS
Cleveland Pneumatic Tool Co., Toronto, Ont.

SHOT AND GRIT, SAND-BLAST
Pangborn Corp. Hagerstown, Md.

SNAP FLASKS
American Foundry Equipment Co. New York City.
Damp Bros., Mfg. Co., Toronto, Ont.
Diamond Clamp & Flask Co., Richmond, Indiana.

SNAP FLASK JACKETS
Damp Bros., Mfg. Co., Toronto, Ont.

STEEL BANDS
Damp Bros., Mfg. Co., Toronto, Ont.

TUMBLING BARRELS
R. MacDougall Co., Galt, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio

VALVES
Cleveland Pneumatic Tool Co., Toronto, Ont.

WELDING AND CUTTING SUPPLIES
Dominion Oxygen Co., Toronto, Ont.

INDEX TO ADVERTISERS

To keep an even balance with the particular, on the one hand and the peculiar, on the other, is something of an art; Stevens' Plumbago (direct from India) is doing just that.

It is suiting the most fastidious.

When you question that, in the least, send for a free working sample and prove my assertion. State the class of molds, whether for cylinders, for flat or raised and indented surfaces like ornamental Stove Plate and your prescription will be filled.

My warehouses are filled with good stocks of Foundry Equipment and Supplies; Electro-Plating Equipment and Supplies for I not only manufacture Foundry Facings, but, also Buffing Compositions and Brass Foundry Supplies.

Canadian shipments made from warehouse at Windsor, Ontario, thus avoiding all bother to the buyer from Custom House details.

STEVENS' STAMPED STEEL LADLES

All sizes in warehouse stock, from 60 lbs. to 250 lbs. capacity, each ladle is stamped from a single piece of steel.

FREDERIC B. STEVENS

INDIANA BRANCH:
Hoosier Supply Co.,
138 South Delaware Street
Indianapolis, Ind.

NEW ENGLAND BRANCH:
Frederic B. Stevens
51 Chestnut Street
New Haven, Conn.
Edward R. Sutton, Mgr.

Manufacturer of Foundry, Electro-Plating and Polishing Supplies and Equipment

Cupola Blocks, Fire Brick and Clay

Corner of Third and Larned Streets
DETROIT, MICH.

Or order from the nearest branch
CANADIAN BRANCH: Windsor, Ont.

PENNSYLVANIA BRANCH:
Frederic B. Stevens
250 West 12th Street, Erie, Pa.
Charles J. Menzemer, Mgr.

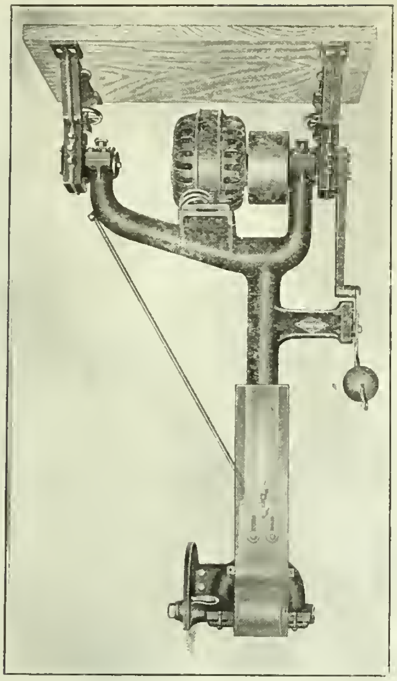
MILWAUKEE BRANCH:
Frederic B. Stevens
1350 National Avenue
Milwaukee, Wis.
A. M. Weis, Mgr.

EDITORIAL INDEX—Page 17. BUYERS' GUIDE—Page 45 ADVERTISING INDEX—Page 48.

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England.

Vol. XIII Publication Office, Toronto, September, 1922 No. 9



No. 152 "Preston" Motor Driven Swing Cut Off Saw

Neither skilled labor nor material have been spared to make this Swing Cut Off Saw the most modern and efficient of any made to-day. Built with special arrangement providing for use of endless belt. Every requirement of a swing cut off saw is combined in this machine. It is a practical, simple and durable machine; absolutely rigid, without vibration and always swings perfectly true.

"PRESTON"

WOODWORKING MACHINERY

Might Make a Wonderful Improvement in Your Pattern Shop

"Service and Satisfaction to the Customer" is the idea of First Importance in our building of machinery, and to assure that we

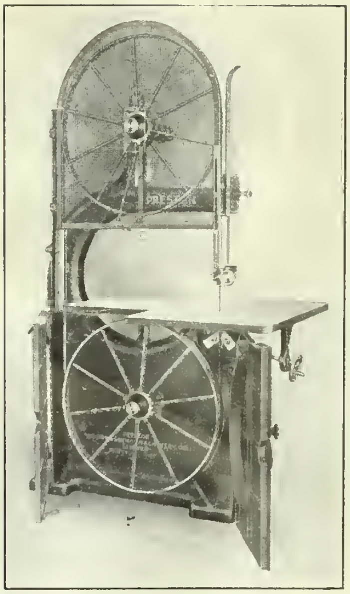
Give the Best We Have

AND

Put the Best We've Got

INTO

Our Work - Your Machines



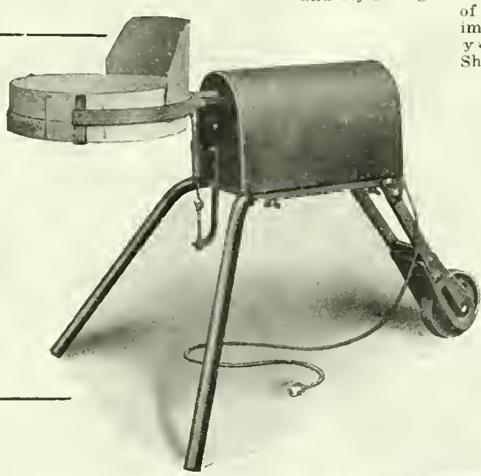
No. 132 "Preston" 36" Band Saw.

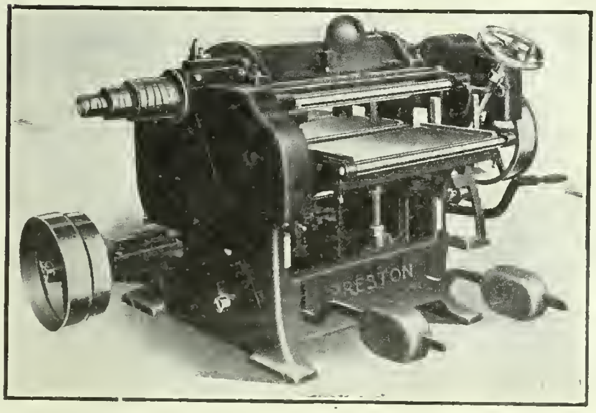
At each point this Band Saw is made a little better than necessary. An almost perfect tension device and style of guide reduces breaking of saws to a minimum. Ideal for your Pattern Shop.

Cut Down The Payroll In Your Foundry

A 15-day free trial of "Preston" Electric Sand Riddle will convince you that it will pay for itself in a few months.

It sifts sand at a cost of one cent an hour for electric power!



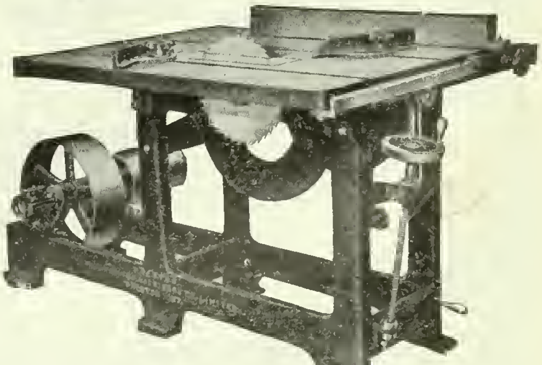


No. 121 "Preston" Heavy Pony Planer

This will be found a practically desirable machine in a Pattern Shop where the work is required to be smooth and true. Made with Round 4-Knife Cylinder or Square Slotted Cylinder.

Make Assurance Doubly Sure

Buy Preston Machines



No. 125 "Preston" Tilting Top Saw Table

This "Preston" Tilting Top Saw Table is a durable machine, practical and simple in design, and the construction is high class throughout. A convenient machine for Grooving, Rabbeting, Mitreing, Beveling, etc.

The Preston Woodworking Machinery Co., Limited

Preston, Ontario, Canada

To Holders of Five-Year $5\frac{1}{2}$ per cent. Canada's Victory Bonds

Issued in 1917 and Maturing 1st December, 1922

CONVERSION PROPOSALS

THE MINISTER OF FINANCE offers to holders of these bonds who desire to continue their investment in Dominion of Canada securities the privilege of exchanging the maturing bonds for new bonds bearing 5½ per cent. interest, payable half yearly, of either of the following classes:—

(a) **Five year bonds, dated 1st November, 1922, to mature 1st November, 1927.**

(b) **Ten year bonds, dated 1st November, 1922, to mature 1st November, 1932.**

While the maturing bonds will carry interest to 1st December, 1922, the new bonds will commence to earn interest from 1st November, 1922, GIVING A BONUS OF A FULL MONTH'S INTEREST TO THOSE AVAILING THEMSELVES OF THE CONVERSION PRIVILEGE.

This offer is made to holders of the maturing bonds and is not open to other investors. The bonds to be issued under this proposal will be substantially of the same character as those which are maturing, except that the exemption from taxation does not apply to the new issue.

Dated at Ottawa, 8th August, 1922.

Holders of the maturing bonds who wish to avail themselves of this conversion privilege should take their bonds AS EARLY AS POSSIBLE, BUT NOT LATER THAN SEPTEMBER 30th, to a Branch of any Chartered Bank in Canada and receive in exchange an official receipt for the bonds surrendered, containing an undertaking to deliver the corresponding bonds of the new issue.

Holders of maturing fully registered bonds, interest payable by cheque from Ottawa, will receive their December 1 interest cheque as usual. Holders of coupon bonds will detach and retain the last unmatured coupon before surrendering the bond itself for conversion purposes.

The surrendered bonds will be forwarded by banks to the Minister of Finance at Ottawa, where they will be exchanged for bonds of the new issue, in fully registered, or coupon registered or coupon bearer form carrying interest payable 1st May and 1st November of each year of the duration of the loan, the first interest payment accruing and payable 1st May, 1923. Bonds of the new issue will be sent to the banks for delivery immediately after the receipt of the surrendered bonds.

The bonds of the maturing issue which are not converted under this proposal will be paid off in cash on the 1st December, 1922.

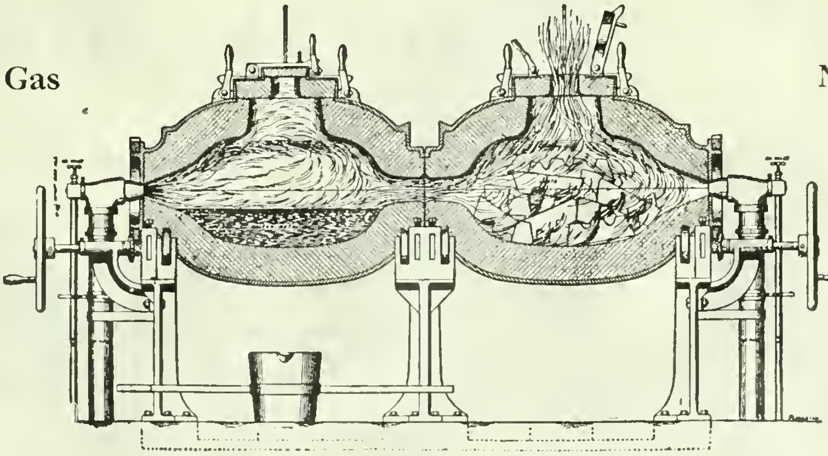
W. S. FIELDING,
Minister of Finance.

The MONARCH

DOUBLE CHAMBER MELTING FURNACE

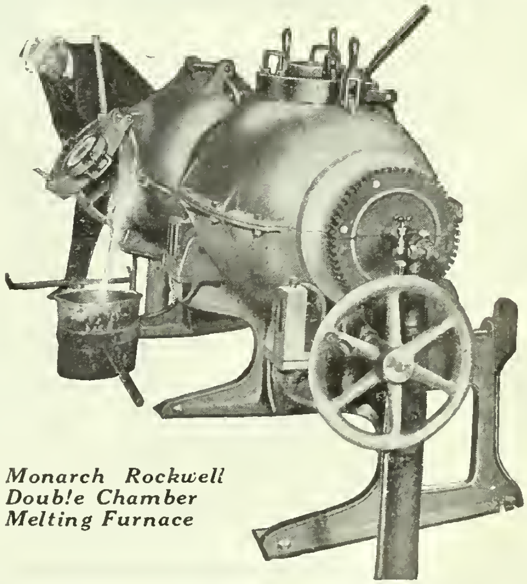
Oil or Gas

No Crucible



No Other Furnace Can Do This For You

The Monarch Rockwell Double Chamber Melting Furnace will melt twice as much metal in a given time, as will any other furnace, and do it without additional fuel. In hundreds of foundries this Monarch Furnace has eliminated profitless waiting. When in use there is no time lost before or after the draw. One chamber can be run off while the exhaust heat brings the metal in the other to near melting point. It not only makes melting practically continuous but it permits melts of various mixtures of metals to follow each other in rapid succession. The economy of this method and the wide range of operation it allows will be appreciated. Incidentally, there is comparatively little loss from oxidation, as, when the **direct** heat is applied, the metal is brought to the molten state very rapidly. We shall be pleased to send you satisfactory proof that it is 50% more economical than any other furnace and to explain in detail how the heat from one burner is utilized for both chambers. We shall be pleased to prove that the **Monarch Rockwell Double Chamber Melting Furnace** will do what no other furnace can do for you. **Write us to-day.**



Monarch Rockwell Double Chamber Melting Furnace

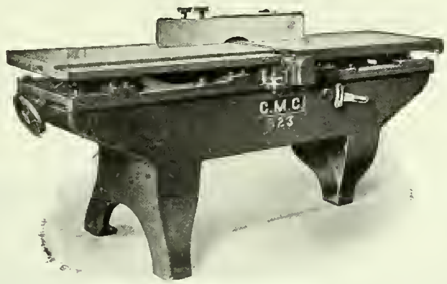
The furnace that will save so much fuel and so much time and ask nothing for upkeep, and nothing but the most ordinary care in operating.

The furnace that will do these things in the years to come as well as it is doing them now—as well as it has been doing them ever since perfected some years ago.

The Monarch Engineering & Manufacturing Co.

1206 AMERICAN BLDG. BALTIMORE, MD., U.S.A

New York Office: 50 Church Street.



No. 823 16″ Jointer

C.M.C.

Pattern Shop Machinery

are quickly adjusted and extremely accurate. No time lost setting up between jobs and each job done right.

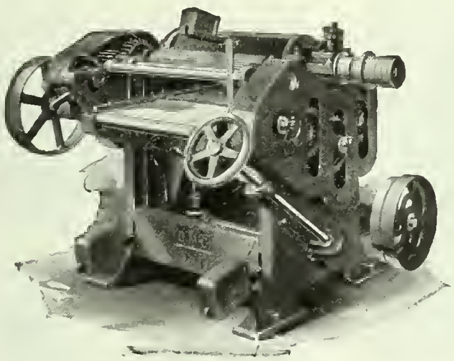
C.M.C. machines are built for the work, and they do produce better work and more of it. The C.M.C. guarantee protects you.

Send for details of the machine that interests you.

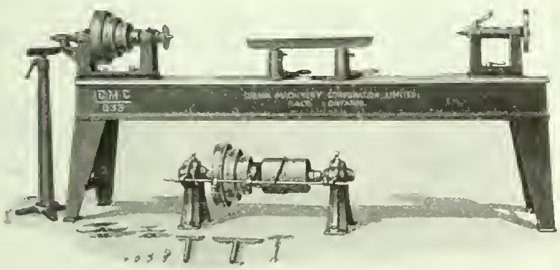
CANADA MACHINERY CORPORATION
LIMITED

GALT - - ONTARIO

Toronto Sales Office: 721 Bank of Hamilton Building



No. 221 24″ x 8″ Heavy Pony Planer



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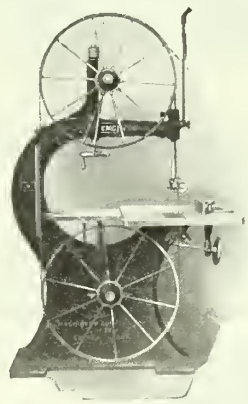

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Industrial Activity Favors Montreal Foundries

Plants Well Employed—Not as Rushed as During the War—Are About as Busy as They Were on an Average Previous to the War

By F. H. BELL

WHEN I say there is lots of foundry work I do not mean to infer that there is any boom on, in any one part of the country more than in another, but I want to make it clear that things have greatly improved over what they were a short time ago. I would also point out that some lines are busier than others, and, of course, the localities in which these commodities are produced will show the most activity. The locality that I will allude to in the present article is that of the City of Montreal and its suburbs, along the banks of the River St. Lawrence, in the Province of Quebec.

To specify the location of this city is probably superfluous and needless, as Montreal needs no introduction from this standpoint.

Montreal is Canada's largest centre of population and one of the large cities of the world. As a point on the map of the world there are few places better known. As a manufacturing city it is of considerable note, but in the true sense in which this expression is accepted, it might not be considered as a leader, particularly from the standpoint of the foundry. The class of work turned out of the Montreal foundries is, to a great extent, what might be termed "built" rather than "manufactured." In regard to number of foundries, Montreal stands second among the Canadian cities, but in regard to jobbing foundries, where ponderous, as well as intricate work is produced, it stands easily first. The castings turned out of some of the Montreal foundries surpass in weight anything turned out elsewhere in Canada.

Reasons Why

The reason why is easily seen, as Montreal is a port of entry for ocean-going vessels drawing thirty feet of water, which includes all but the very largest. It is also far enough inland to be considered as an inland city, so that with the two combined, it is a metropolis in every respect. How this affects the foundry is also self-evident, since practically nothing can be undertaken without the aid of the foundry. In spite of the fact that the foundryman's work is not infrequently buried in concrete or underground or behind a wall, it is nevertheless in evidence, although the labors of the foundryman are too often forgotten.

Some of the Lines

Canada possesses inumerable waterpower possibilities, many of which are not far distant from Montreal. This calls for water wheels. She also has a large percentage of the world's pulpwood areas, and this calls for paper mill machinery. Considerable of this pulpwood is in the Province of Quebec, and the enterprising Montreal manufacturers have availed themselves of the opportunity to build up a legitimate business in a line formerly imported. All of this helps to swell the volume of Montreal's foundry business.

Now reverting back to what is undoubtedly Montreal's greatest asset—that of her port, we will see many things to interest the foundryman.

The Port of Montreal

The port of Montreal extends for miles along the shore of the St. Lawrence, and is made up of long freight sheds with dock on one side and railway track on the other, so that boats discharge their cargoes on the one side and the trains receive them on the other. Thus the sea and the land are connected.

To have this "inland" port any further up the river was impossible on account of the "rapids" opposite Lachine, one of the suburbs of Montreal, so that Montreal can be truthfully said to be at the head of ocean navigation and at the tidewater end of Canada's great inland waterway system to the heart of the American continent. This inland waterway, which connects the Great Lakes by means of various canals, which are required to pass the Niagara Falls and other like obstacles, also connects the two navigable portions of the St. Lawrence by means of the Lachine Canal, which passes through Montreal, thereby allowing the smaller craft from the lakes to connect with the larger ones which traverse the seas.

I have mentioned that Montreal is at the head of ocean navigation, but there are those who would not have it remain thus. There are those who would have it to be just one of the ports of call on the way up to the head of the Great Lakes, the same to be accomplished by deepening the St. Lawrence and enlarging the canals, but then there are others who would prefer to have it remain as it is, and who intend that it shall. Some of these latter ones reside in New York State, while, incidentally some of them are domiciled in this old metropolis of Montreal. These people look upon this deep waterways project, whereby large ships from all over the world could sail right up to Lake Superior, as a huge joke, and are prepared to stake their all that it is.

As every one knows, Canada's predominating industry is agriculture, the Western provinces being devoted to grain, and while it may sound like a broad assertion from a country like Canada, it has for a number of years been known that the largest grain elevator in the world is located at Fort William, Ontario, at the extreme end of Lake Superior. Here the grain is brought from the prairie provinces and stored for transhipment by rail or boat. If the big ocean boats could navigate to these elevators it might be all right, but different people see things differently. However, Montreal is preparing to compete with whatever happens.

As things are, the grain for export must be brought down to the seaboard or else to some port where sea-going ships can dock, and one of these is Montreal. Here the ship meets the two longest railway systems in the world: the Canadian Pacific and the Canadian National. This, like the Ft. William elevator, may sound like strong language from Canada, but it is gospel. These roads connect the Atlantic with the Pacific, drawing on all the territory en route, and either one of them covers more mileage by a good many hundred miles than any other system on the face of the globe.

It must not be supposed that all of Canada's grain is shipped from the port of Montreal or from Canadian ports, as we have powerful opposition from our neighbors to the south, and much of our grain finds an outlet from American ports.

The Two Systems

It is strange how the vagaries of nature shape things so as to make work for mankind. The grain which is shipped by way of New York is brought down the lakes by boat and unloaded at Buffalo into elevators, from which it is transhipped either to the railroad cars or to small canal barges which are towed down the Erie canal and again elevated and discharged into the ocean boat. That which is shipped by the Canadian route is, to a great extent brought down by rail and handled once only, by being put at once aboard the ship for export. With the first system—that of taking it from the lake boat, an apparatus is dropped down into the hold of the boat which licks the grain up like a cat licking milk out of a saucer, and in a course of time the grain all finds its way up into the elevator. With the system being introduced on the St. Lawrence, the freight car is run into the lower part of the elevator, where it is lifted bodily to the proper height and then tilted over on its side, allowing the grain to fall, of its own weight, into the bin of the elevator, from which it is discharged into the boat which is to carry it across the ocean. One of these elevators is being constructed and will be in running order in about one month hence. This with the other dock work such as bollards which the harbor commission and the railway companies are having done, runs into enormous tonnages of cast iron, making abundance of work for the Montreal foundries.

Several tilting elevators are in contemplation, but the one which is now being completed is a big item in itself. It has a lifting capacity of 180 tons. While there are two tilting elevators in operation, one in the United States and the other in Canada, the one being installed at Montreal is in a class by itself. The John S. Metcalf Co. of Montreal are the contractors, and Mr. Hill, the manager of the Metcalf Co., is the patentee. It is so arranged that when it gets to the proper height, the table on which the car rests tilts up on its side to an angle of perhaps 30 degrees. While in this position one end rises up to a still higher angle and lowers again, while the other rises. By this means every particle of grain is unloaded without human aid. Needless to say a machine of this kind would require some high class castings. I am simply describing in a meagre way what might seem to be more of an engineering proposition than that of the foundry in order to show what is going on, and to prove my assertion that the foundryman's part in most every project is overlooked, and the engineering features only are considered. In my succeeding story I will show the mold being made for one of the castings used on this elevator. In the next issue of this publication I will show some other castings of a larger class made in the Montreal district.

SMALL AIR COMPRESSOR

A single-stage air compressor designed especially for the small shop with light requirements for compressed air, has recently been placed on the market. This is particularly suitable for the operation of small capacity hoists, drills, hammers and similar tools. The machine is of the centre-crank, double-acting type, equipped with belt pulley and fly-wheel on opposite ends of the crank shaft.

All valves are readily accessible due to the overhang of the cylinder, which is fitted with an ample water jacket. High speed, multiple port plate valves are used. Moving parts are entirely enclosed and lubricated by the splash system. The oil is prevented from entering the compression cylinder. The gland stuffing is outside the frame and can easily be reached through the ports. The machine is built in ten sizes, the 6 x 6in. cylinder type having a capacity of 57.6 cu. ft. of free air per min., while the 18 x 12in. machine has a capacity of 748 cu. ft. per min. The compressors may be driven either by overhead belt or by motor on the same level. These compressors are manufactured by the Norwalk Iron Works, South Norwalk, Conn.

Molding Heavy Drum in Montreal Foundry

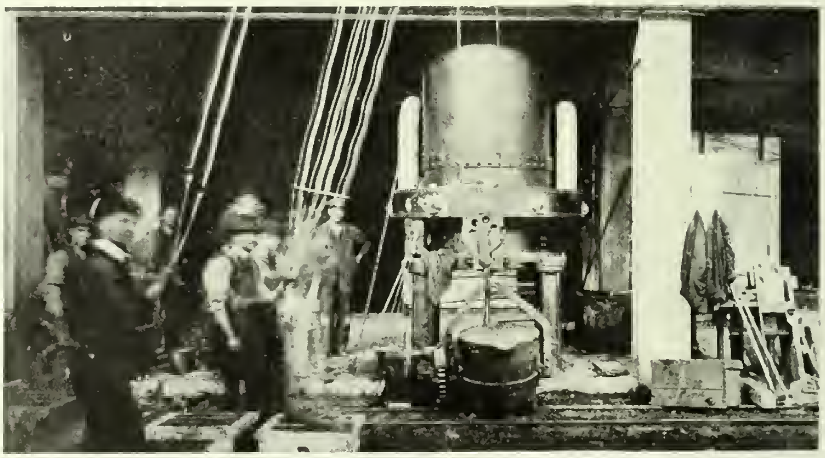
Dry Sand and Cores Used to Advantage—Proper Gating Essential

One of Montreal's interesting foundries is that of Darling Brothers, an inside view of which is shown in the accompanying illustrations. This company has been in operation for quite a number of years as manufacturers of centrifugal pumps and various other specialties, but were dependent on outside concerns for their castings, until four years ago, when they opened up a brand new foundry of their own, where they could do all their own work, while at the same time contracting for considerable outside work, which if required, may be finished in their own machine shop. Here some of the nicest foundry work done in the city has been turned out. The contract for the forty odd bollards, weighing 25 cwt., each of which are required by the harbor commission for placing along the dock, was placed with this firm, while the iron work for the tilting elevator which is being built, is also being done here. All the castings on this job are, of a necessity, of a chunky nature in order to have sufficient strength, while some of them exhibit considerable interesting work for the molders. For instance, the drums on which the cables are to be wound when tilting the tables in the various different directions. These drums when finished ready for use are turned all over the face, and a spiral groove cut for the cable to run in. The casting itself, as it comes from the foundry, consists of a straight drum with an exterior flange on each end, one flange projecting about two inches, while the other projects some six inches. It also has two sets of arms each carrying a cored hub. Six of these drums are required on each machine and they range in length from 27 inches to 58 inches, and weigh from 18 cwt. to 60 cwt.

A casting of this kind looks like a simple piece when finished and in use, but while it is not an overly complicated piece of work it represents a line of molding which is none too commonly practised and understood. It is what might be termed a core job since every part of it, inside and outside, is baked. The one shown in the illustration is the longest one and requires to be made in a mold at least seven feet high. It was not molded in a pit as it would appear to have been, but was lowered into the pit for convenience in pouring.

The flask in which the mold was made was built up with sections about one foot deep. These could be used in whatever number would be required to make sufficient depth. The pattern is solid and all in one piece with the exception of the largest flange, which is loose, and which is to be cast on the lower end of the drum. In making the mold there will, of course, be a parting at the first joint from the bottom, in order that the flange may be drawn. There would not require to be any more partings excepting at the top, but for convenience in placing the mold in the oven to be dried, there is a parting half way up. A mold as high as this will be all the better for having this parting, anyway, since it will dry more evenly by having it as near as possible to the same level than by having one end seven feet above the other.

In placing the cores this parting is also an advantage, as will be seen in the illustration, where the cores are being set. In assembling the mold after taking the different parts from the oven, the drag is lowered into the pit, which had been previously prepared for it, and which is shown in the illustration. This pit would be about three feet in depth. As drying a mold usually distorts it to some extent so that a perfect fit at the joint can not be guaranteed, it is always best to file a little off the joint for a little ways back so as to prevent a possible crush, even though it leave a fin, which will have to be knocked off. It is also advisable to paste the joint, as a precaution against a possible run-



Catching the metal in five-ton ladle. Darling Bros. Foundry, Montreal.

out. This all being done, the first half of the check is put in place, making it appear as shown. The cores can be set to better advantage now than would be possible if the balance of the check had been put in place.

The Cores

The cores constitute the principal part of the job. At the rear of the mold, and a little to the right will be seen the core box. It is simply a V-shaped box with the curved face open. A section of the hub is the V at each end, while the T-shaped arm is loose. A cast iron arbor or grid is rammed into the core and the curved face is strickled off with a straight strike stick. When four of the segments of cores are in place, which is done by lowering them down endwise as illustrated, the hub core shown standing on top of the segment core is slipped into place. The one for the bottom hub is already in place. When all the cores are in place, stud chaplets are placed as shown at the right side, to be sure that the cores are the right distance from the face, and also to hold them there against any possibility of shifting from pressure of metal while pouring or otherwise. The other half of the cheek is now put in place, and the cores chapleted from it, after which the mold is ready for the coke.

Since the big flange is at the bottom and well taken care of, the two inch flange at the top is not hard to cover, and the hub, being entirely in the cores, requires no more coke to complete it, so for these reasons no more coke was rammed up when the mold was being made. A ring core made up of sections of a circle, is placed on top of the upper flange. This core is punctured in four places for pop gates. The empty coke is now put in place, and wedges driven beneath the bars to hold the ring core down. This, of course, in turn holds all the cores down. Gate-pins are now placed in the punctures of the ring core, while vent rods are placed over the cores, the coke is rammed full of sand and the pouring basin made up on top. After clamping the mold together it is ready to be poured. The pop gates are directly over the straight part of the drum, and the metal drops to the bottom, and fills the ouside first, flowing from this through the arms and into the hubs. A thoughtless molder might gate a casting of this kind on the hub, which method would probably run it all right, but it would keep up a continuous outward strain on the cores and tend to spread them. This could be resisted by proper chapleting, but there would be no advantages and many disadvantages. Pouring outside of the cores tends to force them together, and eliminates all risk of trouble. This casting as I have said is not what would be considered a particularly complicated piece to make, but is a nice line of work and offers some suggestions to foundry workmen. The cores are made of ordinary core sand with any kind of binder which will hold up against the weight of melted metal, while the outer part of the mold is made of ordinary molding sand mixed with a little bit of binder to make it hard. Both inside and outside are well black washed before drying.

To the right of the mold, and wearing a white shirt with the sleeves rolled up, is Mr. George Needham, the foundry foreman. Mr. Needham is a Scotsman by birth and served his apprenticeship at Paisley, in his native country. In 1903 he came to America and spent his first fifteen years in the United States, six years being in our neighboring city of Buffalo. He spent some time as foundry foreman with the Bond Engineering Co. of Toronto, and finally settled in Montreal and accepted the position which he now holds, and where his ability as a practical foundryman and executive, and his sterling qualities as a man are appreciated by his employers as well as those under his charge.

Mr. J. Morrison, whose name bespeaks his nationality, but whose extreme modesty prevented his being conspicuous in the picture, is the assistant foreman.

Mr. R. Ratcliffe, who is shown with his elbow on the hub core and steadying the big core into place is the man who made the cores. Mr. Ratcliffe has had experience at his branch of the business in some of the best foundries in the country.

Setting cores in three-ton drum, Darling Bros. Foundry, Montreal.

"WATER-GAS" FUEL

A new fuel—"water gas"—produced by fusing disintegrated water and crude oil in a temperature of 900 degrees, Fahrenheit, has been produced, which, it is claimed will do the work of coal at one third the cost.

This oil water fuel maker is styled the Automatic Siphon Fuel Burner.

The burner is a simple coil of pipe about three-quarters of an inch in diameter, with a nozzle faucet at the outer end. The coil is set in a pan, and under it is a pilot light, lighted with oil, used only to get the flame started. On the right side is a container of crude oil and on the left is a container of water.

The water is first turned on through the coil. In passing through over the pilot light it attains 900 degrees of heat, Fahrenheit, so that its elements disintegrate. In the nozzle faucet these elements mix with a current of oil turned on after the water is heated. When the faucet is opened the oil atomizes and the mixture vaporizes, blowing out through the nozzle as vapor or permanent water gas. As the vapor strikes the heated coil, combustion takes place and a furious flame springs up, at first yellow, then blue and finally violet colored, the coil turning to red, then to white heat. The pilot light is shut off, and the operation thereafter is continuous as long as the fuel is turned on. The whole operation requires less than two minutes. There are 815 volumes of water gas generated to one of water and oil.

NICKEL PLANT RESUMES

Sudbury, Ont.—The plant of the International Nickel Co. at Coppercliff, has commenced operations after having been closed down for eighteen months. The company is operating at one-third of its wartime capacity. Regular shipments of the matte will be made to the refinery at Port Colburne, where all the refining will be done hereafter, the refinery at Bayonne, N. J., having been scrapped. The refined nickel will be shipped to the new $2,000,000 rolling mills at Huntington, Va., where it will be rolled into malleable metal and marketed mostly in the United States.

History of Loam Molding in Province of Liege

General Review of This Branch of the Molder's Art, Together With Some Examples of Typical Loam Molding Jobs—Receipts for Mixtures, etc.

By J. VARLET

This paper, read by J. Varlet, of the Esperance Longdoz Works, Liege, Belgium, at the British Foundrymen's Convention, Birmingham, is useful from the standpoint of its present-day adaptability to the foundry rather than from that of its history, which he has chosen for the title. This history appertains to the city of Liege, evidently, since loam molding was in a more flourishing state right here in Canada in 1846 than it is now. It is a line of molding which should not be allowed to die out. It must be remembered that this paper had to be translated from the French and it may not read just as the writer intended that it should. For instance, reference to Galvanized wire for securing cores must mean tinned wire, as every foundryman knows how zinc behaves when in contact with molten iron. Loam bricks which are referred to along with red bricks are bricks which the molder makes from some refractory though friable material which will hold up against the molten metal but will crush as the casting shrinks, which the red brick would not do—Editor.

THE origin of loam moulding dates from 1846, in which year it was practised for the first time in the Gomree Foundry—thanks to the enterprise of a working patternmaker named Pirson.

He was faced with the necessity of moulding a roll for which it was not convenient to make a pattern. Pirson conceived the idea of making the mould by striking up in a loam and using a spindle and strickle boards; these latter were for a long time called "Placards."

It was not till 1870 that loam moulding began to be generally adopted and that many large foundries decided to produce engine cylinders, condensers, and a number of parts for steam engines by this method. At this date the foundries of John Cockerill, John Roos, and A. Ketin already specialised in loam moulding, which they carried on in a systematic manner, and it is from this foundry that the science of loam moulding was disseminated. At that time there were only available a few exceptional workmen, such as the Marechals, the Galasses, Doyen, and Baguette.

These men, who were real artists, were the actual professors of the period, and it was with almost fatherly interest that they taught young workmen this art of loam moulding, which is the most intellectual part of foundry work, and which requires the most complete knowledge of engineering design.

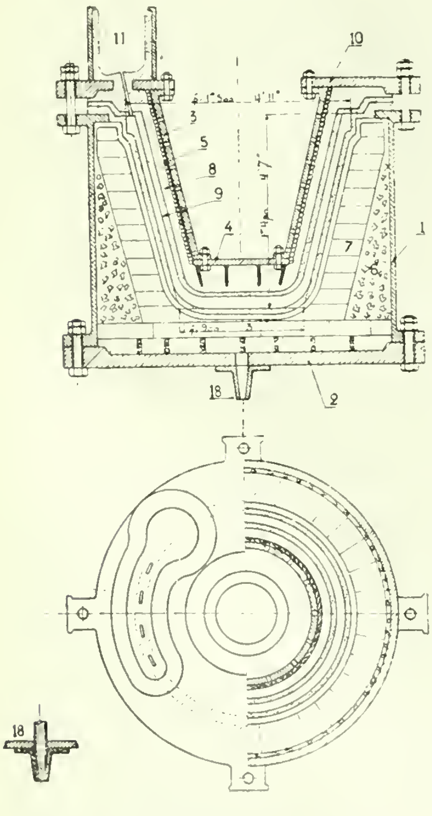


Fig. 1—Plan and section of a loam mould for a slag ladle.

In this occupation the artist is revealed by the facility with which he handles the loam and by his insight and capacity for organizing his work.

About 1880 loam moulding began to attract still more attention. Many young workmen interested themselves in this branch of foundry work, and there was a veritable rush into the new profession, which was considered a justifiable title, as being much superior to other sections of foundry work.

Course of Training for Loam Moulders

The young men who had taken up foundry work had learnt sand moulding or perhaps core-making; they were young coremakers who followed their inclination and their aptitude for the craft, and took up loam moulding after five or six years' apprenticeship to coremaking. Each of these young men had to go through a course of mechanical design, and in 1880 there was in the City of Liege, only one professor, Monsieur Rosa, who taught mechanical design with special reference to moulding, and he never had less than 40 pupils. These lessons were given each Sunday for three hours, and the pupil paid 1 franc per lesson.

When the young coremaker was equal to reading his drawing and to making all the sections and views of a cylinder, condenser pump, etc., and if he had the aptitude already mentioned, he made application with a view to entering the loam moulding department. There he was attached as assistant to a leading moulder, under whose tuition he perfected his workmanship, and in time became a leading moulder himself.

Notwithstanding this system of tuition there was not less than 60 to 70 per cent. of failures; that is to say, workmen who never rose above assistant loam moulders or were obliged to return to coremaking.

It was in 1890 that the number of loam moulders reached its height; large important foundries had 10 to 25. The work was at this period perfectly executed, and the cost of production reached its lowest level. In addition, it was not uncommon to see castings struck up in loam which had previously been moulded in sand. The general appearance and skin of these castings was much superior and extraordinarily enough cost of production was lower than in the case of the same castings sand moulded (today the contrary would certainly be the case).

The Life of the Leading Loam Moulder in the Workshop and After the Day's Work

If one examines the life of these workmen one cannot help being astonished to notice how much we have gone backward from the point of view of love of work.

The leading moulder was animated by a sincere love for his profession; he had the respect of his chiefs; he respected himself, and, above all, he conducted himself as an artisan of an intellectual pro-

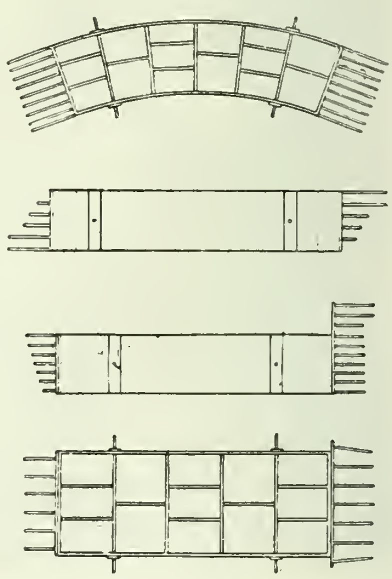


Fig. 2.—Box parts, etc.

fession, who had the right to everyone's consideration.

The loam moulder worked with his hands in the foundry and with his head at home. When he received from his employer the drawings for an important casting, he sometimes took them to a corner of the foundry for a preliminary

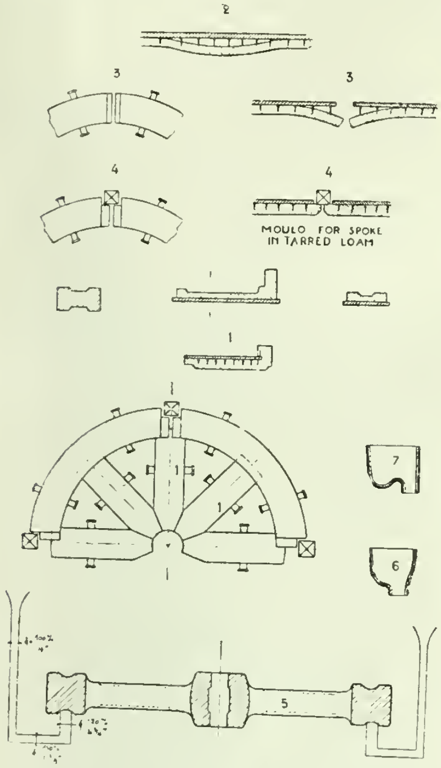


Fig. 3—Details for Flywheel moulding.

study, but in any case he studied the drawings at home and organized his work for the next day.

Methods of Working

At this period various works had adopted two methods differing widely from each other.

The first consisted in the moulder making a full-sized drawing on large wood panels of the casting he had to make. The second consisted in the moulder sketching out, after a preliminary study of the drawings handed to him, all the strickle plates and grids which he would need to make the casting.

The second method was much superior to the first. It required of the workman a deeper knowledge of the construction of the moulds, and the work was considerably more rapid.

In the method of making a lay-out to actual size a great deal of time was required by the moulder for the execution of these drawings. After that the workman familiarised himself with his drawings, which he consulted continually, and as in these views he saw all the mould faces, his comprehension and execution of his work was greatly facilitated, but his labour was less intellectual than in the other method. This process developed the workman but little, but tended to mechanical labour, and it is noticeable that the workmen who practised it were much less capable than others in the art of loam moulding and were less intelligent.

By the other method, on the contrary, the workman very quickly conceived the complete construction of his mould, and one may say that when he had studied his drawing for an hour he could see the casting on all its faces. To quote here the old proverb:—

"One is only a loam moulder when one can see the completed casting one hour after having received the drawings." This means that after an hour of study a moulder should be able to foresee all that is necessary for the successful production of the casting.

The workmen practising the latter method were much more valuable than those of the other school, who were never able to compete with them either from the point of view of quality of work or speed of production.

Equipment

In considering the tools employed by the loam moulders of that period one is forced to feel respect for these artisans and to recognize their exceptional ability in being able to produce such perfect results with such primitive tools, or almost none at all.

Whilst now we have available such modern tools as traveling cranes, jib cranes, forced draught mould dryers, special mould tubs, and numerous strickles—most of which are patented—machined plates, pneumatic tools for ramming up large castings, there was available, even in 1890, only crude equipment; the workman had to cut a centre with a chisel in a cast-iron plate so as to form a strickle, with a spindle often weighing 140-150 lbs. These strickles were fixed and had to be constantly checked with a plumb line; mould tubs did not exist. Instead, a hole was dug in the foundry, and in order to make sure of the work, the moulder made the hole much greater than the mould itself, so that there was always the space of about 3 to 4 ft. which has to be filled in with sand and rammed by hand. This great thickness was indispensable, seeing that in order to resist the pouring pressure of the metal, it was necessary to arrange a layer of pig-iron in the form of a grid so as to stiffen the walls of the mould. It was not uncommon for the cooling of a casting made in loam, such as the cylinder of a steam engine, to require three or four days to complete. The loam and the sand, in the condition of mortar, were mixed in a heap with a shovel and crushed with the feet or a bar of iron, whereas to-day there are at our disposal sand mills and mixers of excellent design.

Loam Moulding at the Present Day

Nowadays loam moulding is not so much practised, owing to the disappearance of certain types of steam engines. Foundries still have loam moulders, but these are employed as much on core-making as on moulding. Only some of the large works who still make occasionally steam engines, turbines, etc., have a section for loam moulders.

On the other hand, methods of work have changed; they are quicker when the work is convenient for repetition production, and as often as possible a duplex method is practised, part sand and part loam, as will be seen from the drawings which follow.

Loam Moulding

A loam mould is composed:—(1) Of a base upon which the mould is built (this base is furnished with a strickle spindle when the casting in question is round). (2) Grids which follow the shape of the casting, which strengthen the mould and allow the parts to be lifted. (3) Red bricks and loam bricks, which form the bottom and the sides. (4) Loam (slurry), which forms the first layer covering the bricks. (5) Sand (slurry), which forms the last layer and constitutes the skin of the mould before the layer of blacking.

The loam and sand mixtures are generally made up as follows:—

Loam Mixture.—Waste core sand and loam bricks 50, clay 20, old foundry sand 10, tan (tannery waste) 20 per cent., and water ad lib.

Sand Mixture, No. 1.—Quarry sand 75, horse manure 25 per cent., and water ad lib.

Analysis of Sand.—Silica 93.3 iron oxide 0.90, alumina 3.5, magnesia 0.10, lime 0.60, and calcination loss 1.50 per cent.

Sand Mixture, No. 2.—Quarry sand 68, horse manure 10, hard coke grindings 12, waste firebrick grindings, 10 per cent., and water ad lib.

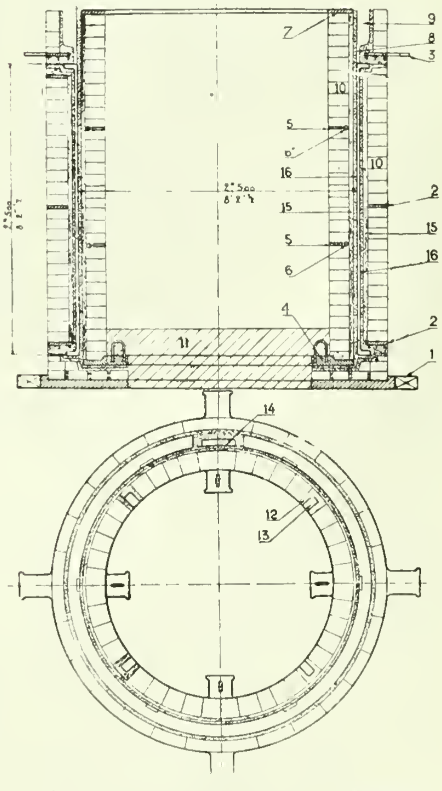


Fig. 4—Plan and section of a Callender Loam Mould.

Sand mixture No. 1 is used for general purposes and No. 2 specially for castings of large area and great thickness.

Slag Ladle for Steelworks

When a foundry is attached to steel works it has to make slag ladles regularly, for which the mould should be

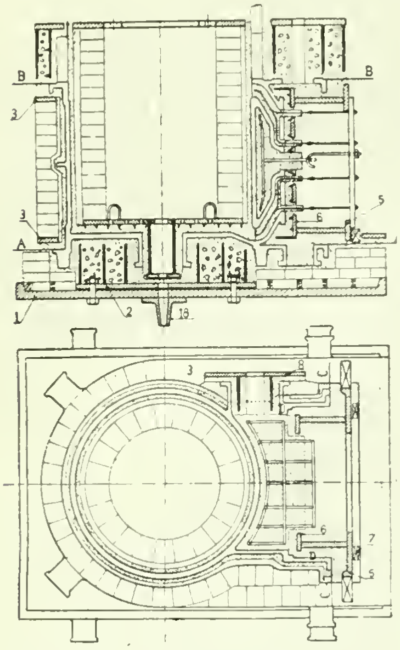


Fig. 5—Details of marine engine cylinder mold.

constructed as in Fig. 1, where (1) is a wrought or cast-iron shell; (2) a base bolted to the shell; (3) a core-iron bolted to a cover plate; (4) a bottom plate for core-iron, which must be unbolted before removing the core-iron from the core; (5) straw rope; (6) layer of sand; (7) red bricks; (8) loam mixture; (9) sand mixture, No. 2; (10) cast-iron cover; and (11) runner bush.

When a casting is poured, it is possible the same day or the next morning to lift the core-iron, which does not stick to the mould, the straw ropes being burnt. In cases where straw is not interposed between the sand and the core-iron, it is impossible to lift the latter owing to the contraction of the casting, and the labor of chiselling the core-iron free is very slow.

In cases where there is only one casting to make, the outside of the mould is made in sand and the core in loam without a core-iron, the latter being replaced by red bricks but still using straw rope as indicated. For repetition work it is sufficient after having lifted out the casting to remove the top layer of sand from the mould and sweep up again directly. In the case of the core, the straw, a layer of loam, and a layer of sand must all be replaced.

The maximum labor for this class of casting is 15 to 18 hours for one man. The weight of the casting is about 3 to 4 tons.

It is noticeable that the slag ladles have a longer life when moulded in loam than when moulded in sand, the iron being closer where in contact with loam surfaces. It is also noticeable that the interior is better finished by moulding in loam than when sand is used.

Composite Moulding of Large Flywheels, Part Loam and Part Sand

Formerly heavy flywheels of large diameter (18 ft. to 23 ft. dia. or more) which were too large to be made in a single moulding box, necessitated a very great amount of labor, and occupied a large area of the foundry over a long period; often six to eight weeks passed by before valuable space thus occupied (90 to 110 sq. yards) could be recovered for the moulding of other castings. This slowness was due to the system of using small box parts for the rim and the arms and to the necessity of working up patterns for these parts and the enormous quantity of gaggers required to keep the sand in position in the small box parts, etc., shown in Fig. 2.

These box parts for the rim and the arms had to be finished at each end with grids, having wrought and cast iron pins, which were adjusted according to the shape to be followed at the hub and the rim, which required considerable labor, as the box parts had to be tried on the mould many times before they could be definitely fixed in place.

The New Method.—The new method of moulding these large castings consists in making one part in loam, such as the top part mould of the rim and the arms.

The labor is greatly reduced, and it is possible to strike up the shape of the flywheel directly. Once the rim is strickled, and the hub made, it only remains to make the arms; one pattern will obviously enable these to be moulded in a minimum of time.

The loam part consists in making slabs to cover the rim (four or six according to size), a plate for the hub, and a slab for each arm. This work is very rapid; a coremaker can finish the whole in ten days.

For the arms, a pattern is made in tarred loam. The slab follows the contour of the arm, the rim, and the hub. These slabs are worked up in a very short time (Fig. 3, No. 1). After remaining a night in the drying stove, the first arm is lifted from its pattern, and the second is made, and so on. By this process two moulders and one coremaker can easily finish a 20-ton flywheel in three weeks and a 30-ton flywheel in four weeks, the comparison being:—

Old Method.—Three moulders and a laborer for 30 days of 10 hours, say, 300 hours x 4 = 1,200 hours, plus 80 hours for the cores = 1.280 hours.

New Method.—Two moulders for three weeks = 2 x 3 x 48 = 288 hours; one laborer, 80 hours; one coremaker, 120 hours; making a total of 488 hours. Taking 500 hours as a round figure, the ratio is 1 : 2.4.

Chief Difficulties Encountered

The periphery finished, the assembling of the rim and arm slabs was proceeded with, afterwards the mould was dried by portable hot-air mould driers. As a result, the top part of the mould (the parts in loam) absorbed a large part of the moisture from the lower portion and became spongy; some of the thin layers of loam buckled and formed air pockets (Fig. 3, No. 2), and were washed away by the metal; the blacking did not stick to the spongy surface, and thus the casting had a rough and scabbed appearance.

A second trouble occurred at the joints of the loam slabs, often caused by slow pouring. The expansion of the sand on the periphery of the wheel, due to radiation from the metal, caused crushing at the joints and formed gross defects at these points. It often happened also that the slabs, half an hour after pouring, having absorbed the maximum amount of heat from the casting and expanding several inches, broke the sand at the joints still further, which forced its way into the pasty metal and thus formed a large cavity at each joint (Fig. 3, No. 3). To cure these serious defects, we proceeded in the following manner:—(1) It is sufficient to dry the bottom part mould in the early stages, perhaps the first day, or by the laborers of the night gang, covering the rim and arms with sheet iron; after blowing through hot air for seven or eight hours, the moisture is driven off, the sheets removed, and the assembling of the rim and arm slabs proceeded with; the mould drier is again used for about the same period; the loam part does not then receive the moisture from the sand. (2) The edges of the slabs at the joints are beveled, wedges are driven between them, iron to iron, and their expansion has then no effect on the joint. In addition, the speed of pouring, as we shall see later, only allows a slight expansion of the sand before the mould is completely filled (Fig. 3, No. 4).

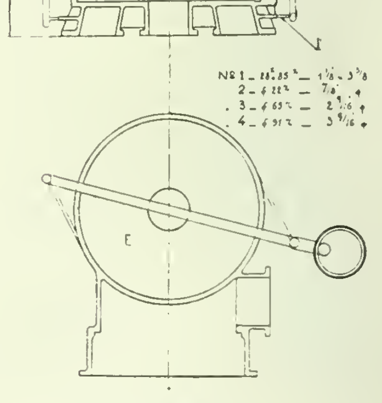


Fig. 6—The arrangement of the runners and risers.

Pouring

The casting is bottom run at the rim (see Sketch 5) and with an expanding ingate, which causes the metal to flow easily on the sand of the runner. To pour quickly at constant pressure through a constant area runner causes sand washing, the speed of the metal increases heat radiation, burns the facing, and gives rise to scabs, etc.

It is well established that it is possible to pour a flywheel by using a system of expanding runners, or in other words a reduced pressure system (Fig. 3, No. 5). The author believes that a 20-ton flywheel ought to be poured in one minute, and he has often poured flywheels of 10, 12, and 15 tons in 44 to 50 secs.

It is important that the upper of the mould be subjected to radiation from the liquid metal for as short a time as possible. The metal is poured from two ladles holding 10 to 15 or 20 tons according to the weight of the casting. The metal is decanted from one ladle to the other to ensure a homogeneous mixture, otherwise, as already mentioned, there is a possibility of unequal stresses being set up during contraction which may cause cracks, particularly in the arms.

In order to enable a large body of metal to be emptied into the reduced pressure runners, funnel-shaped runner bushes are employed (Fig. 3, No. 6), as skimming bushes similar to No. 7 will not take the metal quickly enough.

Loam Moulding a Sugar Cane Calender

Large calenders (Fig. 4) of 8½ ft. dia. x 6½ ft. to 9½ ft. high and of generally thin sections (not more than 1 in.) are castings which require great care to ensure success. It is impossible to guarantee success with a sand mould, owing to the friable nature of the sand, and especially of the large surface of the mould, perhaps 22 to 27 sq. yards. In addition, the great height and the speed of pouring cause disintegration of the sand, the metal scouring the walls of the mould strongly as it enters. Loam moulding, therefore, offers a more certain chance of success.

Mould faces in loam are not disintegrated by the scouring action of the flowing metal, and they are not burnt so quickly when Mixture No. 2 loam containing coke, which has a minimum expansion, is used.

This sand is very refractory (notwithstanding its high calcination loss of 20 per cent.), it has a very hard surface, very often at a thickness of ¼ in. to ⅜ in., and more so at a thickness of ⅝ in., which is the thickness that should be used.

The gases easily escape, and it is unusual for the sand to wash in the runner, even in the case of high pressures, large bodies of metal and great heights. The sand withstands the force of the metal without crumbling.

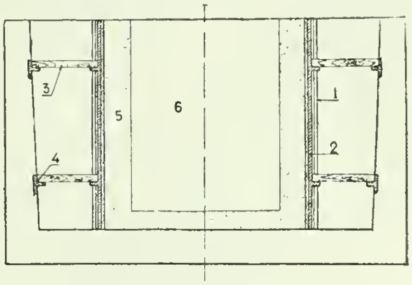
For this kind of casting, loam moulding is much quicker and, as a general rule, may be taken as little more than 60 per cent. of the time occupied for the same mould in sand.

Two essential features need to be observed:—

(1) The cast-iron rings in the core (Fig. 4, No. 5) must be in one piece and not cut on one side for expansion. These rings made in one piece greatly strengthen the core, but in order to permit of the contraction of the casting (2) they must be faced with straw rope (Fig. 4, No. 6). This is absolutely necessary, otherwise the resistance to contraction would crack the casting, whereas when the straw is burnt a space is formed between the ring and the outer layer of sand which permits free contraction.

Pouring the Calender

The casting is poured from the top by means of small ingates, well separated (Fig. 4, No. 8), the metal being poured into a trough (No. 9). It is



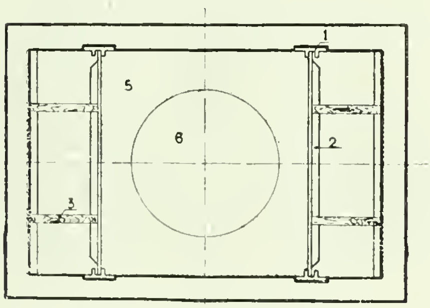


Fig. 7—A convenient casting pit.

necessary to keep the runner-bush full and to pour as hot as possible, as the ingates (No. 8) should not be larger than 3-16 in. x 2½ in.

The core should be rammed hard with a pneumatic rammer, in the lower portion, to a height of about 20 in.; in order to avoid run out at the bottom joint a weight of 5 to 7 tons, with a fairly large area, is placed on the layer of sand rammed at the bottom, the rest of the core being left free. This makes an appreciable economy in labor. The escape of the gases takes place with great rapidity, which, in the case of thin castings, is a factor of primary importance.

In regard to the core the cast-iron rings inserted in it make it very resistant to the pressure of the metal. Three hours after pouring the sand layer (No. 11, Fig. 4) is removed, and the rings (No. 5) are rapped with a light hammer so as to detach from the layer of sand; five hours after pouring a groove is cut from the top to bottom of the casting in the loam bricks (No. 12) inserted for the purpose in the core. This operation reduces the total core thickness by half (No. 13), and gives elasticity to the core, allowing the casting to contract naturally without strain.

Special Recommendation

The bottom ring (No. 4, Fig. 4) should be entirely contained in the print, at least 2 in. below the casting, so as not to interfere with the contraction of the latter.

It is imperative that the core and the mould be bolted to the baseplate, or otherwise heavily weighted, as the height from which the metal falls produces a serious head of pressure, enabling the metal to penetrate into the base, forming a flash, which may lift the core. The outside of the mould must be rammed as hard as possible, otherwise there is danger of bursting.

In Fig. 4 1 is a base ring; 2 covering ring for the collar and reinforcement ring; 3 cover ring and support for pouring through; 4 bottom ring for the core; 5 intermediate rings to reinforce the core; 6 straw ropes; 7 top ring for clamping the core; 8 runners; 9 pouring trough; 10 red bricks; 11 layer of sand; 12 loam bricks; 13 grooves cut in the loam bricks three hours after pouring; 14 feeding head or riser; 15 layer of loam (open grain); and 16 layer of sand with coke.

The time required for moulding this casting is 70 hrs. for one moulder and an assistant.

Moulding a Large Marine Engine Cylinder

Moulding a large cylinder in loam has for its object production of casting of regular thickness and free from defects. By moulding in loam it is possible to arrange the joints of the mould in all the necessary planes, so that assembling and coring up can be carried out with the certainty of correct thicknesses being attained, the various cores being secured by iron wires or bolts. In a loam mould (Fig. 5) holes can be cut for certain cores, such as for the pipes (No. 8, Fig. 5), of which the core can be inserted from the outside of the mould so as to to unite with the exhaust core, fixing it by a joint and a wedge on the outside, which takes a bearing on one of the mould grids.

The cylinder shown here would be jointed in the following manner, so as to secure the maximum facility for locating the cores and the parts of the mould, adjusting the thicknesses and fixing the whole by means of galvanized hooks, wires, etc., to the interior and exterior of the mould.

Contraction of the Mould

The mould would be built up on a cast-iron baseplate (No. 1) made very solid, not less than 2½ in. to 3½ in. thick, and with a rim on the outer edge. A cast-iron grid (No. 2) would be at-

(Continued on page 37)

Grey Iron Castings— Their Chemical Analysis

Carbon Situation—High Sulphur in Castings Made During the War—How it May be Reduced—Some Comments on Melting in Cupola and Electric Furnace

By DR. RICHARD MOLDENKE

IN WORKING out problems in machine design the mechanical engineer is constantly confronted with requirements for those parts he wishes to make of cast iron which make it necessary for him to be informed upon the latest developments of the foundry industry. Where to use a casting and what metal or alloy to make it from should be pretty well known by now, but what class of cast iron to use and what kind of a foundry to get it from may be matters open to doubt in these days of rapid changes.

2 Cast iron, with all its lack of homogeneity and consequent requirements of large factors of safety, is nevertheless of such variety in physical properties that few engineers are familiar with the many uses to which it can be put satisfactorily. It may run from glass-hard to dead-soft, from a condition of brittleness to one of considerable toughness and elasticity, appear silvery to black in fracture, may be made acid-proof and also yield to acid attack promptly; and, strange to say, may exhibit some of these diametrically opposite properties in the same casting. Therefore, even though he depends upon the foundryman to deliver him the kind of casting he needs, the engineer should have some knowledge of the underlying causes for the peculiar properties exhibited by cast iron when put into the form of castings.

The Carbon Situation in Cast Iron

3 To understand the nature of the complex material known as cast iron it is necessary to go behind the returns of an "ultimate analysis," as it were, in order to get the "rational" analysis, or the grouping up of the several elemental constituents. Here it will be seen that the total carbon is present in two forms, part of it being a mechanically mixed crystalline graphite and the remainder being chemically combined. Then there are iron silicide, phosphide and sulphide, the last two compounds being distinctly crystalline when present in comparatively large proportions.

The amount, distribution and physical condition of the graphite thrown out of solution at the moment of set are the more particular items of importance to the engineer in connection with the strength and machinability of the casting. While the total carbon of the metal is the same throughout the mass, the division into mechanically mixed graphite and combined carbon will be such that the highest proportion of the former will be found in the center of the section together with the least of the latter form, and vice versa at the periphery. Since the presence of combined carbon in increasing proportion means a corresponding increase in hardness, the metal at the surface of a casting will be harder than in the center. Further, the oxide of iron formed through contact of molten iron with a damp mold surface and the fluxes in the molding sand if not properly covered with adhering graphite, on interacting form an enamel which is very hard on the cutting tool, and hence this should be made to dig under the skin of the casting and lift the surface metal away as it cuts along under lubrication of the graphite present, and not be allowed to glide over the skin.

4 With the foregoing explanation of the carbon situation in cast iron, and remembering that graphite is in mechanical admixture only and consequently is an element of weakness by cutting up the continuity of the iron mass, it will be understood that fundamentally cast iron is a steel of given combined carbon content, with the other elements present in much higher percentages than one would expect in any steel. For instance, if the percentage analysis of the chips taken from the first eighth inch below the surface of a flat plate gave silicon 2.00, manganese 0.70, phosphorus 0.45 and sulphur 0.12; with graphite 3.20 and combined carbon 0.30; then that part of the plate was for practical purposes a 30 carbon steel containing much graphite, double the usual sulphur and ten times as much phosphorus as a steel ought ordinarily to contain. The analysis for the carbons is advisedly given as representing the first eighth inch of the flat plate and not the whole of the plate, as would be the case for the other items of the analysis. The fact that the proportions of the two forms of carbon vary from surface to center conclusively shows that while the total carbon of a cast-iron analysis may be perfectly reliable, the items "graphite" and "combined carbon" in such an analysis are worthless unless the actual point from which the sample has been taken is indicated.

Considerations Regarding Chemical Composition of Castings

5 So far as the chemical composition of cast iron is concerned, it may be said that silicon as the chief determining factor of the condition of the carbon present may run from as low as 0.35 per cent. in deeply chilled castings up to 3.25 per cent. in the very lightest of hardware and novelty work. The absence of silicon allows the carbon to remain in chemical combination with the iron. As the percentage of silicon increases the iron loses its power to hold the carbon in combination and it is thrown out as graphite at the moment of set. The higher the silicon, the greater the graphite percentage. A factor affecting the silicon content to be employed is the rate of cooling of the metal when a mold is filled with molten iron. The thinner the section the greater the power of the iron to hold the carbon in chemical combination in spite of the silicon present. Hence high silicon is necessary to prevent thin sections from turning out hard, and since the foundryman must deliver his castings in condition to machine properly, he naturally regulates the silicon of his mixture to care for the thinnest section. He has the further difficulty of contraction with which to contend. Cast iron with the carbon all combined—or "white iron"—has a casting contraction of ¼ in. to the foot, whereas with the carbon all as graphite this contraction (erroneously called "shrinkage") is only half as much. If the foundryman were to aim for strong iron with a reasonable machinability for the heavier sections of the casting to be made (the blueprint showing that these sections go under the planer, etc.), making his mixtures accordingly with high steel-scrap percentages and comparatively low silicon, the thin rib and brackets of the casting would come out hard and brittle, if not actually white in fracture, and the greater contraction of these in cooling from the molten state would cause bad warping and internal strains. The mechanical engineer should therefore study the metallurgical side of the foundry requirements so that he may design his work with the least abrupt changes in section, avoid sharp corners and distribute his metal to the best advantage—in other words, give the casting a chance.

6 The total-carbon percentage has come to be a most important factor in the iron-casting industry. Of recent years the comparatively low-total-carbon iron made in the air furnace, and called "gun iron" from its use previous to the days of the steel cannon, has been paralleled by cupola metal in which great quantities of steel scrap are added to the mixture. Even in the air furnace the former long periods of refining to reduce the total carbon are shortened by adding all the way up to 30 per cent. of steel scrap to the mixture of pig irons and home scrap. The product gets the erroneous name of "semi-steel" from those who are not informed on the properties of this grade of cast iron—for it is only a

high-grade cast iron, with none of the properties of steel. Its importance to the engineer lies in the fact that the ultimate strength is nearly doubled by adding the steel scrap and that the comparatively cheap iron casting need not be replaced by the more expensive cast steel. The foundryman, however, has a problem before him in running these high-steel-scrap heats. Only the best cupola and mold-gating practice will yield castings free from blowholes, cracks and serious internal shrinkages. The silicon percentage must be watched particularly, so that separation of graphite and combined carbon may leave the latter low enough for proper machinability. The effect of low total carbon (it may be brought down to 2.25 per cent., or just above the line of division into steel), if the combined carbon is kept normal, is to give an otherwise lower graphite percentage. Necessarily this graphite is finer in crystallization, and there being less of it than normal, the planes of separation in the solid metal are smaller and fewer, hence the greater strength. Moreover there is much less phosphorus present as the result of the low phosphorus of the steel added.

7 Manganese in the castings should not be allowed to run below 0.50 per cent. nor over 1.00 per cent. for normal machinable work Phosphorus should be as low as possible, considering the pig irons that must be used, and for important and thick work had better run below 0.40 per cent. Very thin castings, such as art and architectural details in structures—which really correspond to the "stove plate" of the foundryman, require very nearly 1.00 per cent. of phosphorus to come out in perfect detail. Table 1 gives recommended composition of castings for many purposes. It is not wise for the engineer to specify the chemical composition of the castings he requires, but if strength is important it should be specified, according to the standards of the American Society for Testing Materials.

Specialization in Iron Founding

8 The foundry industry is pretty well divided up into specialized lines of work. If the engineer needs chilled castings he turns to the makers of chilled rolls. Many foundries, however, other than roll makers produce crusher castings, balls for grinding, and shoes and dies for stamp mills. Another important branch of foundry work is the making of cylinders. For the highest grade, foundries having air furnaces should be selected, particularly if they make a specialty of cylinders, piston rings and the like, and these will be found among the great foundry and machine works of the country building heavy machinery and engines (particularly of the marine type). Castings to withstand high pressures, such as those of air, steam and ammonia, are made by foundries specializing in air compressors, pumps, refrigeration machinery, and the general valve and fitting trade. For light parts to serve for ornamental purposes there are many stove shops to which recourse may be had. In general, however, where reciprocating parts or sections of intricate character and subject to severe strains are required, it is safer to go to the large concerns making well and favorably known lines of product. The foundries connected with such establishments have the proper facilities and the trained men to undertake the work, and will be in position to advise improvements in design to give the metal a better chance for the purpose intended. Foundries of the class just mentioned usually have need of several mixtures of iron to supply the parts required for the line of machinery turned out. Hence they usually run a few charges of fairly low-silicon, high-steel-scrap metal for such castings as air-compressor cylinders, rolling-mill parts, and other work of high strength and density. The next charges may then care for ordinary machinery castings, and finally a few extra soft or high-silicon charges may care for pulleys and the very light-section product. Sometimes the process is reversed, all light, soft work being run first and the harder classes at the end of the heat.

9 On account of the lack of elasticity and its massiveness, cast iron is ideal for frames for machinery of all kinds, and as it can be locally chilled to give

TABLE I RECOMMENDED ANALYSES FOR VARIOUS CLASSES OF CASTINGS

Castings	Light					Medium					Heavy				
	Si	Mn	S	P	T.C.	Si	Mn	S	P	T.C.	Si	Mn	S	P	T.C.
Acid-resisting	2.00	0.75	0.05*	0.20*	3.25*	1.50	1.25	0.05*	0.20*	3.25*	1.00	1.25	0.05*	0.20*	3.25*
Agricultural	2.50	0.60	0.06	0.75	3.75	2.25	0.70	0.08	0.70	3.50	2.00	0.80	0.10	0.60	3.25
Air Cylinders	1.90	0.70	0.08	0.50	3.40	1.50	0.80	0.09	0.40	3.25	1.00	0.90	0.10	0.30	3.00
Annealing Boxes						0.65	0.20	0.08	0.20	3.50					
Automobile Cylinders	2.25	0.65	0.08*	0.40*	3.25*	2.00	0.75	0.08*	0.40*	3.25*					
Balls for Grinding						0.75	0.50†	0.15*	0.40*	3.75†	0.50	0.50†	0.15*	0.40*	3.75†
Bedplates	2.00	0.70	0.08	0.60	3.75	1.75	0.75	0.10	0.50	3.50	1.50	0.80	0.12	0.40	3.25
Boiler Castings						2.00	0.80	0.06*	0.20*	3.50*					
Car Wheels											0.65	0.50	0.08	0.35	3.50
Chilled Castings												1.00	0.06*	0.20*	3.50*
Chills						1.00	0.50	0.05	0.20	3.00					
Crusher Jaws						1.00	1.00	0.04	0.20	3.50	0.80	1.25	0.06	0.20	3.25
Dies for Hammers						1.50	0.60	0.05	0.20	3.00	1.25	0.80	0.06	0.20	2.75
Dynamo Castings	2.50	0.50	0.05	0.75	3.75						2.15	0.50	0.06	0.50	3.25
Electrical Work	3.00	0.50	0.03	0.60	3.75	2.75	0.50	0.05	0.50	3.50					
Engine Frames						2.00	0.60	0.08	0.50	3.50	1.75	1.00	0.10	0.40	3.00
Fire Pots, Grates	2.25	0.60	0.05	0.20	3.50	2.00	0.80	0.06	0.20	3.25					
Fly Wheels	2.00	0.50	0.05	0.50	3.50	1.50	0.60	0.06	0.40	3.25	1.25	0.70	0.08	0.30	3.25
Friction Clutches	2.40	0.60	0.10	0.70	3.75	2.00	0.70	0.12	0.50	3.50					
Furnace Castings	2.40	0.60	0.05	0.60	3.75	2.15	0.80	0.06	0.50	3.50					
Gas-Engine Cylinders	2.00	0.70	0.08	0.40	3.25	1.50	0.80	0.09	0.30	3.00	1.25	0.90	0.10	0.20	2.85
Gears	2.25	0.60	0.08	0.70	3.75	2.00	0.80	0.09	0.60	3.50	1.50	1.00	0.10	0.50	3.25
Glass Molds, Pipe Balls						2.50	0.60	0.04	0.20	3.25					
Grate Bars						2.00	0.60	0.05	0.20	3.50					
Gun Iron						1.50	0.50	0.05	0.30	3.25	1.00	0.60	0.05	0.30	3.00
Hardware	2.50	0.70	0.08	0.80	3.75										
Heat-resistant Iron						2.00	0.80	0.06	0.20	3.25	1.50	1.00	0.06	0.20	3.00
Hydraulic Cylinders						1.50	0.80	0.05	0.40	3.25	1.00	1.00	0.08	0.20	2.85
Ingot Molds											1.25	0.80	0.06	0.20	3.75
Machinery Castings	2.50	0.60	0.08	0.70	3.75	2.00	0.80	0.09	0.60	3.50	1.50	1.00	0.10	0.50	3.25
Mine Wheels						0.90	1.00	0.10	0.20	3.00					
Ornamental Castings	2.75	0.60	0.06	0.90	3.75	2.25	0.70	0.08	0.80	3.50					
Pipe (Water)	2.25	0.60	0.06	0.80	3.75	2.00	0.80	0.08	0.70	3.50	1.50	1.00	0.10	0.60	3.50
Piston Rings	2.00	0.70	0.05	0.60	3.50	1.75	0.80	0.06	0.50	3.25					
Pulleys	2.40	0.50	0.05	0.70	3.75	2.15	0.60	0.07	0.60	3.50	1.90	0.70	0.09	0.50	3.25
Radiators	2.25	0.70	0.06	0.80	3.50										
Rolls (Chilled)							0.80	0.06	0.40	3.25		1.00	0.08	0.30	3.00
Soft Castings	2.60	0.50	0.06	0.60	3.75	2.40	0.60	0.08	0.50	3.50					
Soil Pipe	2.25	0.60	0.08	0.80	3.75	2.00	0.80	0.10	0.60	3.50					
Steam Cylinders	2.00	0.60	0.08	0.50	3.50	1.60	0.80	0.09	0.40	3.50	1.25	1.00	0.10	0.30	3.50
Stove Plate	2.50	0.50	0.06	1.00	3.75	2.25	0.60	0.08	0.80	3.50					
Valves	2.25	0.60	0.07	0.50	3.25	1.75	0.80	0.08	0.40	3.00	1.25	1.00	0.09	0.30	2.85
White Iron Castings						0.75*	0.20†	0.25*	0.75*	2.50†					

*Below. †Above.

splendid wearing surfaces where needed, built-up structures of several materials can be avoided. The reduction in the total carbon through steel additions to the mixture can be carried to a point when the chips taken from such a casting curl up almost as well as those from hard steel, and hence such metal serves very well where it is not essential that steel be used.

Recent Tendencies in Gray-Iron Foundry Practice

10 A few words on the more recent tendencies in the production of gray-iron castings will not be amiss. The passing of the war has given us time to realize more fully the train of evils that have been its legacy to the foundry. A cataclysm such as this cannot but have disorganized everything it has touched, and so the foundry is manned to-day by operatives giving but part of the output of previous days, the character of the work is itself poorer, corrective measures are impossible of application, and hence the industry is far behind the present demand for castings. Until labor seeks work, conditions will be no better, and prices are the rule which take into account all kinds of eventualities. So much for the operating end. On the technical side matters are just as bad. While there was a tremendous expansion of other industries due to war demands, the foundries simply pushed production to the utmost consistent with ability to get raw materials and men. Impossible prices for pig iron resulted in the use of so high a proportion of scrap in the mixtures that when the castings made during this period of stress eventually land into the scrap piles of the country—probably within the next twenty years—a serious problem of very high-sulphur and oxidized iron will confront the foundryman. Instances of 90 per cent. scrap in the mixture were common and castings with over 0.20 per cent. sulphur equally so.

11 The problem will have to be faced, and there are two possible solutions. The method heretofore employed in such a case is the increased use of pig iron in the mixtures. Before the war the common practice was to use not over 40 per cent. scrap with 60 per cent. pig. Now it is reversed. Consequently, instead of having the sulphur run about 0.08 per cent. maximum in important work, it is more nearly 0.12 per cent. Ordinary work to-day touches 0.18 per cent. without much comment. It is true that even a higher sulphur content will not militate against machinability provided the melting practice is of the very best, but the castings are more subject to danger from shock and casting strains.

12 The other method for correcting the high-sulphur tendency in daily work at present and for that to come, would be a desulphurization process. Until very recently no method of this kind was available, but fortunately the electric furnace has been drawn upon for this purpose and is doing the work with complete satisfaction. Instead of melting the charges from the cold state, as is the case in electric-steel developments, the regular cupola method is employed and the molten metal is transferred into an electric furnace having a basic lining. In this way the heavy current variations are avoided and by taking advantage of the comparatively cheap cupola-melting cost, that of the electric furnace for refining only is very materially reduced. It is a question whether more than a quarter of a cent. is thus added to the cupola melting cost per pound of metal "duplexed," where current is cheap.

13 Molten cupola metal with possibly 0.12 per cent. sulphur may thus be brought down to about 0.05 per cent. and even lower. Moreover, the metal is highly superheated—cupola metal itself is intensely hot as compared with furnace iron—and thoroughly deoxidized. The castings made are therefore much better and sounder than the ordinary run, equaling charcoal-iron castings made in the air furnace. The first cost of the installation is high but soon pays for itself in the quality of work turned out. While developed during the war period it is none the less a logical sequence in the world advance of the art of making iron castings, and should be welcomed as a satisfactory way out of a very bad situation ahead.

14 In conclusion, the mechanical engineer is urged to turn his attention more specifically to foundry operation. The technical staffs of all the foundries of continental Europe, from manager down to assistants in the several production and testing departments, are all graduate engineers. The consequence is that castings are made strictly for the purpose intended and not merely to get by the machine shop safely, as is unfortunately so often the case here. Close co-operation between men trained in the science with those trained in the art of making castings can result only in good.

PROPERTIES OF SEMI-STEEL

We have not read so many complaints during the last year or two about the non-progressiveness of the foundry, says the Engineering World. The fact is that the foundry industry has become very enterprising and has made greater advance since 1914 than almost any other department of engineering. It is not that there is very much that is quite new to record, says the Commonwealth Engineer, but rather that there has been a wonderful development of processes that, while introduced a long time ago, have not until recently been exploited to the fullest extent. Die casting, for instance, is at least 40 years old; the malleable process has been in use for a long time, although less than 200 of our 3,000 foundries produce malleable castings, and America is far ahead of us, and semi-steel which has come into prominence of late has been tried out in many quite small jobbing foundries, admittedly in a haphazard fashion, for very many years

Exact knowledge is indispensable to the successful production of semi-steel, which, taking its qualities into consideration, seems likely to contest the field with malleable iron castings where strength is required at less cost than for steel castings. It is much stronger than cast iron, more homogeneous, therefore less porous, and it offers greater resistance to wear. The mixture may be described as one of 10-25 per cent. of steel added to ordinary grey iron. The very greatest skill in cupola operation is necessary to get good results, and although the Americans have paid greater attention to the metal than we have done, it is being used increasingly for high-class work where sound metal is indispensable. The electric furnace is very valuable in foundries producing semi-steel because scrap can then be successfully used.

With regard to the physical and chemical properties of semi-steel, much depends, of course, on the mixture, but it has been calculated that the strength above that of ordinary iron is from 25 to 60 per cent. Tests have proved that with a 10 per cent. steel mixture the average transverse strength is 2,900 lb., as against 2,252 lb. It has been defined as a decarbonised cast iron. Its composition chemically limits both phosphorus and sulphur to 0.15 per cent. maximum, and the carbon to 3.2 per cent., of which 20 per cent. should be combined carbon.

There is still room for a great deal of experimental and research work on semi-steel.

PORTABLE CRANE

A new industrial portable crane has been placed on the British market recently. This crane is electrically operated and can run in and out through the doorways of warehouses and stockrooms and can be placed alongside a motor truck or railway car, that requires to be loaded or unloaded in the shortest space of time. It has a jib type of crane which is mounted on a "runabout" chassis, without the usual turntable arrangements. That is to say, that the crane is rigidly attached to the chassis and always remains in the same relative position to it. Motive power is supplied by storage batteries to electric motors. The two steering wheels can be turned so that the whole crane will revolve by power about its own axis without any motion of translation. The capacity of the crane is 1,500 pounds, at a radius of ten feet in any position in the circle, with a height of hook of twelve feet. The crane is guaranteed to sustain an overload of 25 per cent. The overall width of the apparatus is six feet. It rotates in a circle of 6 feet 3 inches in diameter. The weight, including the drive, is about three tons. The crane can travel at a speed of about 300 ft. per minute and will hoist at a speed of twenty feet per minute, and slews at the rate of 2½ revolutions a minute.

Apprentice Course on Brass Foundry Practice

Must Begin at the Bottom and Work Up—Copper the Earliest Known Metal and Still the Base on Which Non-Ferrous Metal is Founded

By F. H. BELL

The founding of metals, as I have endeavored to show, in my papers on antiquity which have been published in these columns at different times, dates back a few thousand years, but "man" struggled along for countless ages without it until he finally discovered that it filled a place which had hitherto been unfilled.

That copper was the first metal to be brought into service, goes without much argument, although there are those who contend that there is evidence to show that iron was used at an equally early date. It is doubtful, although possible, that iron existed long ago and has all been eaten away by corrosion or oxidation, but there certainly is nothing to back up such a contention.

The history of copper, or of any other metals for that matter, would be of little real value to the foundryman who wants modern practice were it not for the fact that the whole fabric of metallurgy and founding is woven into this beginning. The evidences which I have been endeavoring to bring out from the antiquities displayed in museums, of edge tools made from pure copper, would certainly seem sufficiently convincing that copper was the only metal in use at one time, else why would a soft metal such as it be used, if a metal capable of being hardened was available?

The belief that hardening of pure copper is a lost art which was once practiced is denied by those whose business it is to gather up antique specimens for the museums. It is claimed by these authorities that no speciman now in existence is any harder than ordinary copper.

The metal, zinc, which is used as a hardening alloy for copper, has not been known to mankind for a very long period, but it was, of course, in existence, and the theory is advanced that the ancients, believing that they were hardening the copper by a heat-treating process, were in reality alloying it with zinc, by case hardening it, as it were, in clay which was impregnated with zinc oxide.

We know that carbon can be introduced into soft wrought iron by the case-hardening process after it has been machined, making it possible to do all the machine work on the soft piece and then have it hardened afterwards. This may possibly be the way in which copper tools were hardened unbeknown to those who were doing it. Certain it is that soft copper cannot be anything but soft copper unless something else is introduced to harden it.

The same holds good with cast iron and steel which could not be hardened were it not for the fact that they contain foreign matter such as carbon which is changed chemically by sudden cooling. Remove the carbon from cast iron or steel, and it will not be affected by cooling. This is most likely the case with the copper which had absorbed zinc. Pure copper tools were embedded in clay which they did not know contained zinc, and after being kept hot for a length of time, they would come out harder than they were. This, of course, is only a supposition, while there is the possibility, that they did know that the clay contained a hardening mineral, and then there is the other possibility that there never were any hard copper tools, since none of them are to be found to-day, and since iron and steel drove copper off the market as a material from which to make edge tools.

Copper

Believing copper to be the pioneer of all the metals, and believing that it cannot be changed constitutionally by any other means than by the introduction of some other material we will endeavor to build up the brass foundry business of to-day on this foundation:

Copper is the one metal which is found in large quantities in a comparatively pure state, in which state it is known as "native." This is probably the reason why it was the first to be known and used.

Nomenclature

In olden times the Island of Cyprus, in the Mediterranean Sea, was the chief source of supply of the metal, and it was from this that it derived its name, being first known as cyprium, afterwards Latinized to cuprium and later to cuprum, which is still the recognized technical name; the chemical symbol being cu.

Copper, in its pure state, has not been used for the production of castings to any great extent, for the reason that it can be made stronger, harder, tougher, and in fact, better in most every respect by being alloyed with some other metal or metals. There is a strong possibility, however, that much of the brass spoken of in the Scripture was simply copper, although copper is mentioned in one and only one place in the Old Testament. Ezra, 8th chapter, and 27th verse, in describing the building of the new temple at Jerusalem to take the place of the one destroyed by Nebuchadnezzar, mentions among the goods returned by the king of Persia, "twenty basins of gold of a thousand chains, and two vessels of fine copper, precious as gold." Now while this is the only place where copper is mentioned, it was in all probability, not pure copper at that, but an alloy which was intended to imitate gold.

Pure copper castings, as I have already said, are not much called for, and if they were it is a very difficult proposition to produce them on account of the strong affinity which copper has for oxygen. Melted copper, no matter how rapidly handled, will oxidize on its way from the crucible to the mold, and the oxidized metal will show in the castings.

Electric Requirements

There are, however, places where pure copper castings are desired. In electric machinery there are castings which should be pure copper to give the best results, as pure copper is a better conductor of electricity than any of its alloys. The drawback has been that unless some other material was added to deoxidize the copper it would produce castings with oxide spots which were more injurious than an oxidizing agent. As a consequence, zinc has been used in the proportion of two pounds of zinc to one hundred pounds of copper. This has the desired effect in cleaning the metal and does not lessen its conductivity to a very great extent. A more recent method is to use silicon in the proportion of 1% which does not change the chemical analysis nor effect the conductivity. Magnesium in a very small proportion is also an agent which will be described later.

Before proceeding with the subject of copper and its alloys it would be as well to look into what has to be accomplished and then see how to accomplish them. It would also be in order to settle upon a name for the compositions which will be made from the various metals.

Ferrous and Non-ferrous

Founders long ago decided that iron was in a class by itself while the other metals were in another class. Iron, in chemistry, is known by its Latin name "ferrum" and any metal which is not in the iron or "ferrous" class is known is "non-ferrous." This expression is commonly used when speaking in a general way and we will use it for the present.

Castings made from non-ferrous metals are used in some instances where great strength is required, in others where wearing qualities are essential, still others put antifriction as of most consideration, while again color is of prime importance. Springs are sometimes made of brass, or I should have

(Continued on page 30)

Useful Hints for the Pattern Maker and Molder

Hints Whereby the Pattern Maker May be Enabled to so Construct His Work as to Work Most Advantageously for the Men in the Foundry

By J. DRINKWATER

MOST patternmakers and foundrymen in the course of years accumulate a great many useful workshop hints which are valuable not so much as set methods of procedure but as sign posts. Thus a wrinkle, while in principle remaining the same, may be modified in many ways to suit the particular job. The hints outlined in this article comprise but a very few of those as sign posts. Thus wrinkle, while in indeed the ground is so vast that it could not be covered in an extensive series of articles but the writer has found these hints useful and many of them are not as widely known as they should be.

Dividing A Mould

It is often necessary to accurately divide a swept up mould for wheel work and also for other purposes, and Fig. 1 represents a very satisfactory way of doing it. It is not suggested of course that it would be economical to make the necessary tackle if only one casting was required and there was no possibility of similar orders being received, but it is a very exceptional foundry which cannot find, if not regular, at least frequent use for such a device. B represents a cast iron wheel with a boss which is bored to slip over the spindle. The periphery of the wheel is chalked and divided at the patternmaker's bench either with a scriber or with a pencil into the number of teeth ribs, etc., which are required on the casting. A metal pointer is then made similar to A and clamped to the strickle as shown. To divide the mould the strickle is moved round, the pointer indicating each division. A very accurate result is obtained.

Strickling Small Cores

All wood strickles are very clumsy for small cores, and for this reason coreboxes are more often made than they need to be. At Fig. 2 is shown one way of making a very satisfactory strickle for a small diameter core. B is made of thin iron plate and is screwed to the end of the strickle. This would not be at all satisfactory for large cores of course. As will be observed the spindle has several holes bored in its length which allows it to be used for various heights of cores. It is only necessary to have one spindle and as the patternmaker knows its thickness he allows for it when making the board. The coremaker sweeps up the core in an iron plate with a suitable hole bored to take the end of the spindle which should be turned or carefully fitted to shape.

Another Strickle Wrinkle

Fig. 3 shows a strickle which would be used for pipe or valve work. Some patternmakers run the grain of the timber at right angles to the strickle as shown in the sketch with the result that the

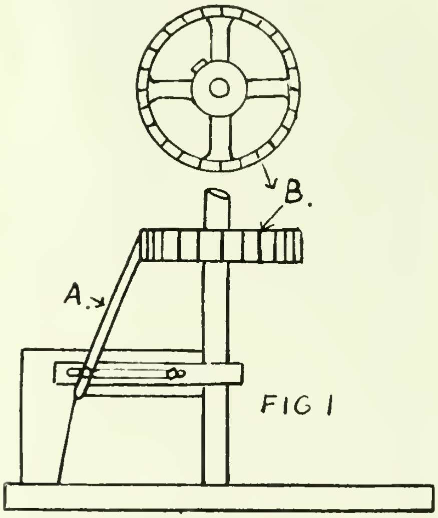


FIG 1

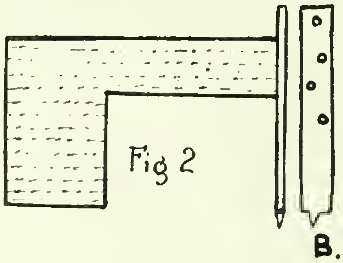


Fig 2

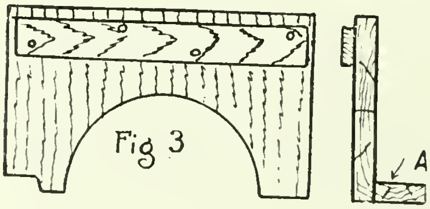


Fig 3

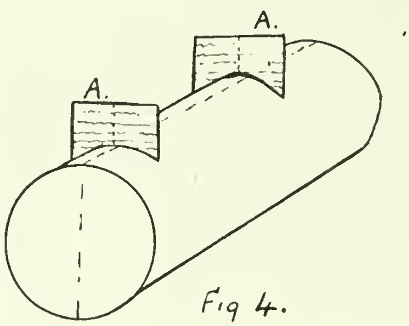


Fig 4.

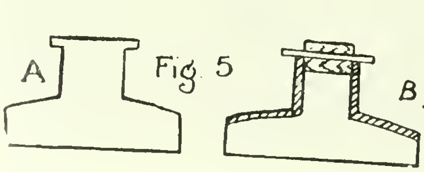


Fig 5

strickle breaks when the coremaker is using it. By making the grain as shown and fitting a top bar a really strong strickle is obtained. An improvement to a strickle of this kind is indicated at A. By screwing a piece like A to the board the coremaker can work with confidence, and there is no danger of the core coming out smaller than a half diameter owing to the board being held off the square. This tip is of greatest value with large cores and where it is adopted saves a great deal of vexatious annoyance. Further it is so simple and easily done that for the coremaker's convenience alone it is worth while.

Cone Centre for Bevel Wheels

The drawing of the teeth centres on a mitre or bevel wheel presents difficulty to the tyro. One good method of doing this is to place a surface gauge on the lathe bed after the work has been turned, divide a diameter, and then mark the centres with the gauge scriber. Another equally good method if a surface gauge is not available is to turn a hole in the centre boss of the pattern and insert a pin with a tapered point which is the apex of the cone.

Centre Line on Cylinder

When a sand pattern is used it is always necessary in order to determine the correct position of ribs, flanges, bosses, etc., to draw longitudinal lines. The simplest method of doing this is clearly shown at Fig. 4. Two pieces A. A. made of 1-inch timber are got out. The length of these pieces is immaterial but the top edges must be at right angles to the centre lines, and the circles which fit on the cylinder diameter must be very carefully finished. By balancing winding strips on the tops of these pieces and "sighting," points can be transferred to each end of the cylinder, after which a centre line can be drawn from end to end, radial square being used to draw centre line on the ends.

Turning a Straight Barrel

After the lagged barrel has been placd between the centres a small length, say 1 inch at each end should be turned to the finished diameter. We can then plane through at a joint, colour with crayon and turn down. This method saves the continual use of a straight edge.

Old Castings As Patterns

A great deal could be written, and indeed has been written, for and against the use of old castings as patterns. There are times when a casting is very urgently wanted and there is no time to make a pattern. On such occasions good castings are obtainable from the old castings if a little ingenuity is exercised. If the moulder has to use a casting as a pattern it is of course more difficult to ensure accurate thickness of metal but as a rule even when a casting is made from a new pattern the thickness of the metal varies slightly, and when an old casting is used as a pattern this error may be doubled. In the valve shown at Fig. 5 the branch cannot be moulded on the joint because of other branches. It cannot be drawn from the joint of the mould so some means has to be devised of getting it out. If the casting is sawn through behind the branch flange a pattern flange with a print screwed to one face and a piece of the same thickness screwed to the other face to serve as a dowel is satisfactory. (See B) The moulder can then draw the body and take away the flange in a loam cake.

A Simple Bar

In making small valve patterns out of soft wood a dovetailed mahogany or other hardwood bar is often fitted on the face or joint of the pattern to prevent its warping. Quite as effective is the method of boring a hole right across the pattern in the rough with an auger bit and driving a hardwood dowel through. It has not the disadvantage of the soft wood shrinking more than the hard wood and leaving an open or "rocking" joint.

A Turning Hint

When turning cylindrical patterns in halves great care has to be taken to ensure that the centre plates are accurately screwed on the ends of the pattern in order that exact halves may be obtained. It is quite customary to have a trial turn and then take out one half of the pattern and test with callipers. It is much simpler to gauge a few lines from the joint as shown at Fig. 6. A glance is then sufficient to show whether the job is out of true. Some craftsmen instead of gauge line inscribe a few circles but these are not quite as accurate as lines.

Jigs

For fitting branches, brackets, etc., various devices can be used in the patternshop which save time and hard work. One of these is shown at Fig. 7 D and E are plan and elevation of a dome shaped pattern on which two feet have to be fitted as shown. There are several ways in which this can be done. Some patternmakers would simply bed down each bracket separately, a method which is not only tedious but seldom satisfactory An improvement on this is to fasten both brackets to a board and fit them at one operation but this is also a rule-of-thumb method only permissible when dealing with very irregular shapes. When it is possible at all, and in most cases it is possible, a jig should be used, for defining the shape. Fig. 7 represents a quick method which is applicable to many jobs, such as branches and bosses on cylinders, etc. It is also suitable for shaping the ends of core-boxes. The two brackets in the case under consideration are screwed down to a board on which centre lines are drawn. Attention may be drawn to the centre pin A and the outer support B. It is possible of course to roughly shape the brackets before using the template C. The best way to use this jig is to finish one bracket completely, roughly draw the other from it, and then change over the board B. If care and accuracy are observed the brackets should find their position on the dome without any extra fitting having to be done.

Drawing Off Segments

Generally a great deal of time is wasted drawing off segments separately with a template. When the template is cut at the bandsaw the board from which the segments are going to be taken should be cut into pieces the same length as the segment. One breadth of segment may be drawn off and the piece stitched to other four or five pieces likewise stitched together. Thus instead of each segment being cut independently at the bandsaw the one cut will give five or six segments as the case may be, another advantage being that they are more uniform in shape than if separately cut.

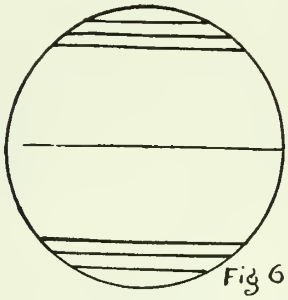


Fig 6

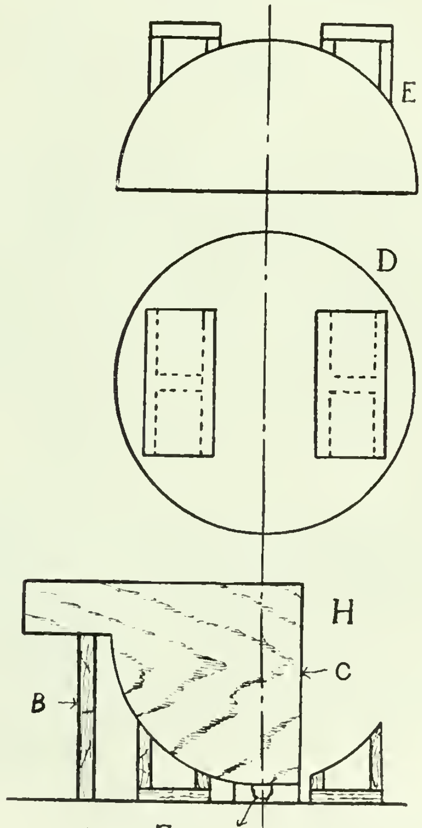


Fig. 7

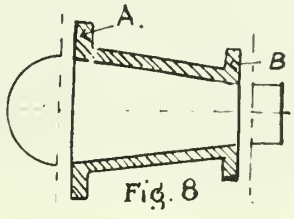


Fig. 8

From Round to Square

Fig. 8 a small pipe running from a diameter to a square is such a job. It is obvious that the shape at the back of flange A is not a diameter nor the shape at the back of flange B a square. A simple method of making this pipe is to cut the timber the distance between the flanges. Dummy ends of the same thickness as the flange are now screwed on. The correct shape should be described on each face and the shape worked from end to end. When this is done the dummy ends can be removed and the flanges screwed on. A square and a round print can be fixed on each end respectively.

This method is very convenient when making spread branches, that is branches which are a diameter at the flange but break into an oval or square or oblong chest

Sandpapering Jigs

Many ingenious devices may be employed for sandpapering work both at the disc and the spindle machines. In Canadian Foundryman some time ago an interesting description was given of jigs suitable for grinding wheel teeth to shape. At Fig. 9 and 10 are shown two very useful guides. If the disc machine has an iron table it is very convenient to fit a wooden table to it in order that jigs may be easily fixed. Fig. 9 shows how segments may be ground to exact shape. This is usually a trimming machine job but it can be done equally as well at the sandpapering machine. The piece B need not be more than 1 in. or 1½ in. thick. A represents the segment. Fig. 10 shows a way in which small pieces may be planed; B. B. being stoppers while A is a strip screwed at the back edge of the guide as a grip.

A Handy Screwdriver

Every patternmaker—and moulder also for that matter—knows the difficulty of taking out screws which are rusted in. A 3 ft. long screwdriver may be used and heat may be applied in vain. The use of the hammer invariably results in the screw heal being broken off. Perhaps the most valuable type of screwdriver for general foundry work is one on which a square is forged near the end. (Fig. 11) Pressure can then be brought to bear on the handle of the screwdriver and a suitable spanner (wrench) fitted to the nut. The most

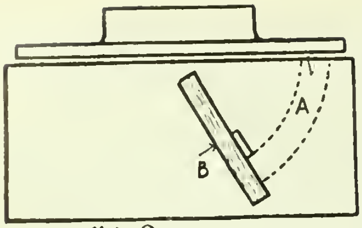


Fig 9

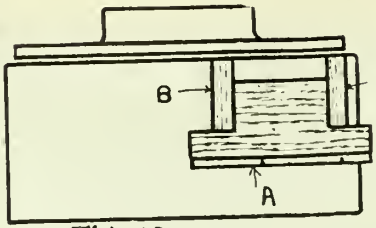


Fig 10

obstinate screws will usually yield to this valuable tool, which any blacksmith can make in a few minutes.

Planing at the Circular Saw

In many pattern shops that have neither planing nor corebox machines much labor is often wasted scooping out the inside or concave faces of staves, etc., with crank gouges before finishing off with the round sole plane. If there is a circular saw in the shop the following simple expedient is economical, and in the hands of a careful workman quite safe. The saw must be well set and sharp. The saw table is raised so that the teeth are just showing above it; then an improvised wooden fence is clamped to it at an angle which either by trial or setting down the saw diameter and the diameter of inside of stave on a shop board and projecting is found correct: a prospective view of saw looking along the fence would give a radius equal to the radius of the inside of the stave. Of course the fence (or fences if it is necessary as in the case of narrow staves—to place a separate fence on each side of saw) would be so fixed that the stave being placed against it, the centre of the stave would strike the vertical centre line of the saw. The saw is now started and the stave held well down by the workman and pushed along the fence. After each "cut" the table may be lowered ⅛ of an inch or less for the next cut. If the operation is carefully executed, the work will require little finishing with the plane.

A One-Pitch Length Worm

The writer at one time had many patterns to make for screws the length of which were the same as the pitch and sometimes less. These screws are used as conveyors for all sorts of purposes, and the pitch is of necessity extremely coarse. There are several ways in which the job can be done but the most economical is that shown in the accompanying illustration, Fig. 12. The first operation is to turn the diameter at the root of the tooth, then two half bushes fitted over this as shown in A Fig. 12. This is replaced in the lathe and turned to the diameter of the face of the screw then the pieces are removed. Paper templates can then be drawn for both the inside or root of the tooth and the face of the tooth. It is then quite a simple matter to cut out roughly at the bandsaw and finish at the bench. B Fig. 12 gives a view of the finished screw. The same quick method of course may be adopted for an ordinary worm with any number of teeth, although for a standard pattern it is not as strong as a worm built or cut out of the solid.

Breaking Out Half-Lapped Frames

In marine shops and indeed all shops where work of a large character is made, the construction of half-lapped frames constitutes a considerable proportion of the work of the shop. Instead of laying the rails on the trestles on the bench side by side, setting the compasses and drawing them off separately, all the cross rails should be clamped together and all the long rails likewise together. It is a simple matter, then, after marking off the top rail, to square down the sides, separate the rails and square over. If there are a number of frames the same size of course all the similar ones may be drawn off at once. The saving of time in drawing frames off like this can only be appreciated by one who has tried both ways. Incidentally it may be mentioned that half-checks should never be tight, indeed in long frames that are not to be painted it is advisable to leave an allowance for the timber swelling when placed in the damp sand.

The difficulty is to know where to stop when writing about workshop tips. We have outlined just a few useful ones in this article and at another time with the editor's permission the writer may have the pleasure of passing more information of this kind along.

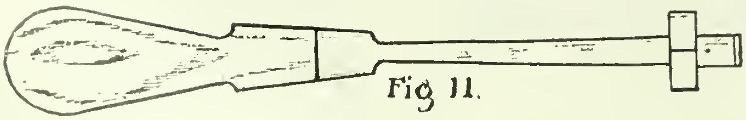


Fig 11.

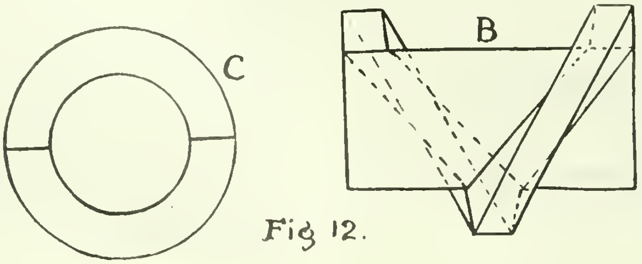


Fig 12.

APPRENTICE COURSE ON BRASS

(Continued from page 27)

said, of non-ferrous metal. These have to be made of metal which will bend, and return to its proper place. Other mixtures are called upon to resist the action of acids while others must be able to resist pressure. All of these and many other characteristics have to be arrived at through the manipulation of the different metals.

Physical Qualities

In order to arrive at the proper analysis, we must first learn what produces the proper physical qualities and then by recording what was used to produce this we know what to use in the future. This is the chemical contact. If we have a piece of casting which shows satisfactory results and we do not know its chemical contents, we have it analyzed by a chemist and his finding is the chemical analysis, and by this means we know how to produce what someone else produced to accomplish the required results.

Stress

Castings, when put to use, are subject to what is known as stress, which is to say that the work which they are called upon to do may be such as to subject them to any of the duties to which I have already alluded. For instance the engineer may call for a casting which will come up to a certain standard, and in expressing this he specifies the stress which it will be called upon to stand or resist. The foundryman in turn has a different expression with a different meaning. He produces a casting with a certified strength. Stress and strength are frequently confused by able writers, but they have distinct meanings. Stress is what the casting must resist, while strength is its ability to resist this stress.

(To be Continued)

SELF-ALIGNING BALL-BEARING PILLOW BLOCK

The essential features of a pillow block that has just been placed on the market are the double ball bearing hanger box and the self aligning pillow block. Both the end and radial thrust is taken by the balls. The bearing automatically aligns to compensate for any variation between the bed on which it rests and the position of the shaft. The inner ring is made very wide, in order to give the bearing a firm seat on the shaft and to afford a greater support to it. Special provision is made for preventing the escape of lubricant or the entrance of dirt. The block has no bolts, screws, or adjustments. It is secured endwise on the shaft by the means of two collars fitted with set screws. These collars have lugs which engage corresponding slots cut in the wide inner ring of the ball bearing. These pillow blocks may be easily installed. The spherical seat in the pillow block and the ball on the box permits the whole unit to align with the shaft. These pillow blocks are manufactured by the Fafnir Bearing Co. of New Britain, Conn.

Canadian Graphite to Lead in the World's Market

Ceylon Mines, Which for a Century Enjoyed a Virtual Monopoly, Practically Exhausted—Canadian Product Equal in Every Respect—Flotation Process Makes Production Profitable

By H. P. H. BRUMELL, Buckingham, Que.

GRAPHITE is a mineral and an allotropic form of carbon of which charcoal is the lowest and diamond the highest form. It is cryptocrystalline, steel grey to black in color, lustrous, lubricous, sectile, very soft and has a specific gravity of from 2.1 to 2.3. It is also highly refractory and has high electric conductivity.

The mineral is known under three names: graphite, plumbago and black-lead, which are used in the trade to distinguish the three different forms in which it occurs, thus: the word graphite is used for the flaky product derived from disseminated ore, plumbago for the crystalline material filling veins or pockets, and black-lead for the earthy or so called amorphous variety. According to the country of origin the trade also uses the three synonyms, thus: Ceylon plumbago, Canadian or American graphite and German black-lead.

Graphite is a prosaic mineral and but little known to the general public, the average layman thinking of it only in connection with pencils and stove polish or as a lubricant in connection with automobiles. No glamour attaches to it as in the case of the precious metals yet it is probably a much greater essential than either gold or silver, nor has any substitute been found for it in its principal uses. It is absolutely essential in the melting and moulding of most metals, in electricity, certain lubrication, lead pencils and stove polish, and is used in a variety of other purposes, the proportions entering into the various trades being approximately as follows:—

Crucibles and refractories	65%
Lubricants	10%
Foundry facings and stove polish	10%
Pencils	7%
Paints	3%
Other uses	5%

If value rather than quantity be considered, over 75% should be credited to crucibles and refractories.

In nature the mineral is found in two forms known to commerce as crystalline and amorphous, the latter being very wide spread in its distribution, while the crystalline variety is restricted, being confined to crystalline rocks of pre-Cambrian age or metamorphic crystalline rocks of a later period, thus the disseminated graphites of Canada and New York states are of pre-Cambrian age while that of Alabama occurs in highly metamorphosed sediments of the Carboniferous series. For the purpose of this paper consideration of the crystalline variety only will be had.

Crystalline graphite occurs in commercial quantities outside of Canada in Ceylon, Madagascar, Bavaria and in the United States. In Canada the deposits are in Central and Eastern Ontario, in Labelle and Argenteuil counties, Province of Quebec, and on Baffin Island, the largest and most important being located in Buckingham township, Labelle county. Criticizing the foregoing occurrences both as to quantity and quality, it may be said that the product of Ceylon is probably the best known but, unfortunately, the deposits have been almost completely depleted and it is the expressed opinion of those most familiar with the field that it is only a question of a year or two before it is entire-

One hundred ton mill of the North American Graphite Co., Buckingham Township, Que.

ly exhausted. The field is small, as has been ascertained by the geological survey of the Island, and it has become a question of deep mining under very expensive conditions as the veins are very narrow and the occurrences such as to preclude systematic mining. In a confidential report to the Department of the Interior, Washington, July 7, 1918, by H. G. Ferguson and F. Grout, the following statement is made:

> "Although no definite data are available, it is believed that the production of Ceylon cannot go on much longer at its present rate, and it is possible that the virtual exhaustion of the deposit is not far distant."

Madagascar has extensive deposits of disseminated ore but the refined material has been found unsatisfactory for the manufacture of crucibles, the most important of all uses to which graphite is put. In Bavaria there are somewhat extensive beds of low percentage disseminated ore from which a very small sized flake is obtained and used locally. The field is not important. In the United States the only important fields are those of New York and Alabama, the ore, a disseminated one, averaging about 5% in the former and 2½% in the latter.

In Canada there are practically unlimited quantities of disseminated ore, assaying from 10% to as high as 30%. Of the known fields of the world those of Canada are by far the most important in extent, percentage of graphite content and quality of product. As may be seen on reference to the list of uses of graphite the making of crucibles is the most important, and it is for this purpose that the Canadian material excels, and it is through this use that Canada will in the next few years, dominate the world's graphite industry. During the past few years the governments of the United States, Great Britain and Canada have been making exhaustive enquiries and investigations as to an alternative source of supply of crucible graphite with the result that Canada has been shown to be the logical successor of Ceylon, which has hitherto supplied the world with this particular material. It was not, however, until the advent of the oil frothing flotation method of concentration had been perfected that it was possible to supply Canadian graphite at a price which allowed any profit to the producer. This perfection of process, coupled with the depletion of the Ceylon fields, makes the Canadian graphite industry a most profitable one.

A comparison of costs of production of crucible graphite, according to governmental and authoritative statement, shows the following:—Ceylon. All material shipped in crude form. Average cost per ton, f.o b port in Ceylon, about $112.00, according to report of United States consul at Colombo, January 1921. To this price must be added freight, insurance, commission, etc., and before the material is suitable for any purpose it must be milled and refined at considerable cost, the total increase over actual cost f.o.b. Ceylon being probably 40%. United States. From "Information concerning Graphite" Committee on Ways and Means, House of Representatives, Washington, 1919, it is learnt that the cost of production of graphite in the United States ranges from $120.00 to $280.00 per ton. Canada. It has been proved at several mills that, from an ore assaying 10% only and with an extraction of 90% only of the graphite content, the cost of production, with oil frothing flotation, is less than $50.00 per ton f.o.b. rail. From records in possession of the writer the factory cost at one mill was $44.00 per ton and at another approximately $47.00. It must be borne in mind that the Canadian material is finished and of high grade as against the crude material of Ceylon.

The following official assays of No. 1, or crucible stock, produced by Canadian mills as well as those of foreign graphite attest the superiority of the Canadian material:

Anglo Canadian Graphite Syndicate, 94.68%; assayer, A. E. Tucker, Birmingham, Eng.

North American Graphite Co. 96.30%; assayer, M. L. Hersey, Montreal.

North American Graphite Co. 94.40%; assayer, Mines Dept., Ottawa.

Buckingham Graphite Co. 95.00%; assayer, Durand Woodman, New York.

Entrance to one of the workings of the North American Graphite Co., Buckingham Township, Quebec.

Buckingham Graphite Co. 98.08%; assayer, M. L. Hersey, Montreal.

Dominion Graphite Co. 91.30%; daily average for two years.

Alabama 87.03%; assayer, United States Bureau of Mines.

New York 88.97%; assayer, United States Bureau of Mines.

Pennsylvania 88.80%; assayer, United States Bureau of Mines.

Ceylon 85.06%; assayer, United States Bureau of Mines.

Madagascar 88.50%; "Foreign Graphite" A. H. Redfield.

For crucible making, size of particle, weight for bulk and purity are all important, and in these respects Canadian graphite is pre-eminent. In the matter of weight the specific gravity of the Buckingham, Que., material, according to G. C. Hoffmann, Geological Survey of Canada, 1876, is 2.2685, while that of Ceylon, acording to the same authority, is 2.2591, and, according to F. G. Moses, United States Bureau of Mines, the Alabama product has a specific gravity of only 2.1. Regarding the size of particle, the crucible manufacturer's specification demands an evenly-balanced stock between the limits of 16 and 90 meshes to the inch which size is, of course, easily obtainable from the crude lump ore of Ceylon, the only disseminated ore affording a similar stock being that of Canada. The following table shows a comparative screen test of No. 1 produced in Buckingham, Que., and Alabama, U.S.:

Screen mesh	Buckingham Separate %	No. 1 Cumulative %	Alabama Separate %	No. 1 Cumulative %
On 30	4	4	..	..
On 40	16	20	11	11
On 50	18	38	..	..
On 60	30	68	37	46
On 70	27	95	..	..
On 80	3	98	30	78
On 90	2	100	15	93
Thru 90	..	..	7	100

The Buckingham stock, above, was produced under the old and very destructive method of dry concentration, while the Alabama material was produced by means of flotation whereby the size of particle is maintained. Notwithstanding this handicap in the methods of concentration it will be noted that 68% of the Buckingham stock stood on 60 mesh as against only 48% of that of Alabama, a very pronounced superiority in favor of the Canadian product.

The market for graphite is a constant one and is rapidly growing as its uses are becoming more generally known. Of late years there has been a tremendous growth in the demand for the mineral in the iron and steel and non-ferrous metals trades, in electricty and for lubrication in which latter regard it is now being more fully appreciated. The markets of the principal consuming countries are approximately as follows:

Germany	40,000 tons per year
United States	35 000 tons per year
Great Britain	20,000 tons per year
Austria	10,000 tons per year
Czecho Slovakia	10,000 tons per year
France	5,000 tons per year
Italy	5,000 tons per year
Belgium	5,000 tons per year
Japan	5,000 tons per year
All others	15,000 tons per year
	150,000 tons per year

The world's production since 1900 shows a steady and marked increase, irrespective of the disturbed years of 1914-1918, as follows:—

1900— 81,683 tons	1910—116,004 tons
1901— 78,920 tons	1911—124,560 tons
1902— 81,901 tons	1912—136,510 tons
1903— 97,673 tons	1913—150,325 tons
1904—100,643 tons	1914—115,068 tons
1905—118,938 tons	1915—124,339 tons
1906—124,187 tons	1916—202,287 tons
1907—143,930 tons	1917—238,683 tons
1908—106,741 tons	1918—226,024 tons
1909—123,382 tons	1919—172,579 tons

In conclusion the writer would draw attention to the opportunity afforded to create, in Canada, an industry which would certainly dominate the crystalline graphite market of the world. It is a trite saying that "crystalline graphite occurs only in crystalline rocks" and of these we have in Eastern Canada the greatest development in the world covering, as they do, nearly the whole of the provinces of Ontario and Quebec. As has been stated the world is now looking for a new source of supply of crystalline graphite and it is understood that the Imperial Mineral Resources Commission is carrying on investigations with a view to aiding in the development of the graphite resources of the Empire as well as those of other refractories such as magnesite, talc, soapstone, etc. Dr. Charles Camsell, Deputy Minister of Mines, Ottawa, is at present in London in connection with this work. Many reports of both the Federal and Provincial Governments give evidence showing the great extent of our graphite land and the value of the ore and product as well as information concerning the treatment of the ore, markets, etc. That the United States Government is alive to the situation is evidenced by the many reports on both domestic and foreign sources of supply.

Careful investigations by prominent engineers and mining men of both Canada and the United States have shown that we have in Canada all the requirements for a very large and stable industry, the consensus of opinion being that it is a milling rather than a mining proposition. The graphite occurs as a rock constituent of enormous masses of gneiss and limestone, the question of production being solely a matter of profitable concentration. The finished material has always been acknowledged to be of the highest grade and eminently suitable for crucible making, though it was not until the exigency of war-time forced it that it was openly acknowledged. Until 1914 it was understood by users generally that only crucibles made of Ceylon graphite would stand up to their requirements. World conditions, however, during the war changed all this, and it was proved that some of the other crystalline graphites were fully equal to Ceylon and the prejudice which had been fostered by Ceylon producers for nearly 100 years was broken down and the crucible maker now cheerfully acknowledges that he is willing and anxious to get his supply of suitable graphite where he can. Commenting on conditions in the Ceylon trade the "Report of Inspector of Mines, Ceylon," 1920, says:—

> "In previous years there have been slumps in the industry, due to temporary lack of demand for plumbago, but the present slump is an entirely different matter, as the demand for plumbago is as great or greater than it ever was, only, unfortunately for Ceylon, the supplies are being obtained from elsewhere. The position could not very well be worse than at present."

The writer is in possession of the records of several mill run tests showing that an average extraction of 96.14% of the graphite content of the ore was recovered from ores averaging 15.41%, all in the Province of Quebec. For reasons that are obvious to the writer no reference to specific properties may be made though he is permitted to make public certain results obtained. At one property in the Province of Quebec a recovery of 97.84% was made from an ore assaying 13.75%. Of the finished material 56% was No. 1 or crucible stock, 19% was No. 2 or lubricating stock, and 25% was No. 3 or ground stock, the three grades assaying 94.40%, 90.25% and 73.10% respectively. At present market prices these would have an average value of $130.00 per ton, while the factory cost of production would be $44.00, a profit of $86.00 per ton of finished material, or a profit on each ton of ore milled of over $12.00.

If there be such a time as a phsycological moment, that moment is certainly the present one in the matter of graphite mining and milling and it is to be hoped that for the credit of Canadians and their well known pride in their country's natural resources, the people of this country will take advantage of it. Our graphite is acknowledged to be the best for all purposes, the ore deposits are almost unlimited, the percentage of the graphite content is the highest known, the system of concentration has been perfected and, as the market is a large one and growing as the use of the mineral becomes better known, there are all the necessary factors for the making of a large and very profitable industry.

A British oil company has been occupied during the last few years in completing one of the largest oil refineries in the world. This refinery occupies a site of about 650 acres near a British port, and it has involved the expenditure of about three million pounds. From the jetties where the tank steamers are unloaded pipe lines are laid down to eight tanks, which are capable of holding ten thousand tons of oil. Electrically-driven pumps are used to convey the oil from these tanks to storage tanks situated at the refinery about four miles away. The storage tanks have a total capacity of nearly twenty-one million gallons.

Statuary Founding Becoming a Regular Line

Toronto Firm Competing Favourably With Foreign Competitors is Turning Out Some Fine Specimens of Bronze Statues and Tablets—Fallen Heroes Must Not Be Forgotten

IT IS an old and familiar saying, that "the good which men do lives after them." This is undoubtedly a true saying, but, unfortunately, while the good lives the men themselves are too frequently forgotten, and many of the greatest benefits which mankind enjoys were accomplished by anonymous benefactors. Yet what less should any man expect when doing his best to have the world better for his having lived, than that after having done his duty and passed on to his reward, not only the good which he had done, but he as well should be remembered?

Not only the heroic dead who gave up their lives for their country and for the cause of civilization, but those noble men, and women too, who have striven throughout their lives to accomplish that which will be of lasting good to mankind, are entitled to something more tangible than mere pageantry at their burial, and what more fitting tribute can the living render to the dead, than to erect to their memory substantial bronze statues which will withstand the ravages of the elements until the end of time?

The founding of bronze statuary is what might be considered as a fairly modern art when compared with the work of the sculptor who carved his statue from solid stone or modeled it in plastic clay, but it, nevertheless, dates back several centuries, and many magnificent specimens of the founders' handicraft still stand as monuments, not only to those whose deeds they were intended to commemorate but to the skill of the artists and the artisans who created them.

The methods employed by the ancients were in some respects similar to those employed today but on general principles they were vastly different. In any case the model must be made by hand. In the olden days the core on which the metal would be finally poured was made first to approximately the shape of the finished statue. Onto this, sheets of wax were laid and pressed in tightly to all the details of the core. This wax would then be correctly finished to exactly the design to be followed in the statue.

The mold would now be built around this core with its wax covering between the core and the outer mold. When completed ready for the oven, the entire mass was baked when the wax would melt and run out leaving the space in which to pour the metal. A complete description of this method would be interesting but it is not the method employed in Canada. In this country a more modern and economical method has superseded the wax process. This method will be described in brief, later on.

In the illustration, Fig. 1, will be seen the statue of a soldier.... feet ....inches in height and weighing ....lbs., cast in bronze at the statuary foundry of Canadian Wm. A. Rogers, Ltd., 570 King St. W., Toronto. This is an old established business concern, in the silverware business, but the statuary department is of recent origin, having been added three years ago, since which time many notable statues and tablets have been turned out. The one here shown is a fair sample of a bronze statue, although usually a base or pedestal on which the statue stands is attached to it. This however is dependent on the wishes of the sculptor or those who employ him, and not on the man who produces the bronze castings. Unlike the ancient statuary founder who was at once an artist, a sculptor and a founder, the present day statue founder takes his pattern as given to him, the same as any molder, and proceeds to make his casting from it, no matter how complicated or apparently impossible it may seem to be. A statue such as the one here shown with its draperies and other adornments would require a mold consisting of several thousand pieces, and would if made by one man require at least four months continuous work to complete the molds alone. It would be quite possible to make the statue such as this all in one piece, but it would be an expensive way, entailing much risk and having no advantages. Instead of this the model is looked over and any part which looks as though it would be better if made separately is removed. Thus in the one shown the legs and lower part of the body constitute one casting; and the bust another, while the head and arms each make another. The different parts of the plaster model are fitted with sleeves which work into one another so that the parts go together when assembling the statue giving it the appearance of one complete casting.

The sand in which this work is done is in a class by itself, and is imported

"GOING OVER THE TOP."
This statue was recently cast by Canadian Wm. A. Rogers, Limited. As will be seen, it has no base, but will stand on a stone base representing sand bags in front of a trench. It stands seven feet and four inches in height and weighs one thousand pounds. It was shipped to Summerside, P.E.I., where it will commemorate those from that district who fell in the great war.

from France, none suitable having been located on this continent. It is what might be termed a strong clay-loam of fine texture; when green it can be lifted about with safety and when dry it is hard and strong. In making the mold a parting has to be made at every pleat or ruffle on the pattern. From this to the next pleat may only be a portion of an inch, and in this small space a core has to be built with the French sand, and a complete parting made all around it. This is similar to what an ordinary molder would call a draw-back, and if the shape of the pocket to be formed is such that this core cannot be drawn back it will have to be made in sections. From this it will be seen how simple a matter it would be to have thousands of these little cores on the entire job, and how easily a month would slip by with several men working on the job. While making the mold for a bronze statue is a very high grade of molding it has some advantages. For instance, if the castings were to be of iron it is doubtful if the metal would lay quietly in the mold. It would also be awkward to secure the core in the manner in which it is done. In bronze statuary work the mold is made first and is afterwards used as a core box in which to make the inside core which will, of course, be the same size as the outside, but which will be scraped down with thickness tools. The arbors for the core are gas pipe, perforated for the vent. These arbors project right out through the casting and are driven out when cleaning the castings, leaving holes which have to be plugged. It might be explained that these little cores which form the outside of the statue are all trowled to a uniform shape on the back and are rammed into iron flasks which are removed to allow of pulling back the cores and removing the pattern, but returned so as to hold the small parts in place. The gate consists of one large opening through the top with a large basin which holds two or three hundred pounds of melted metal. This is plugged while filling the basin, and when the plug is pulled out the pouring continues, the weight of the metal in the basing giving it abundant pressure and at the same time keeping it clean by allowing all dross to float. The single pouring gate simply goes down to the joint over the little cores. Here it is connected, by gates cut all over the joint, to small pop gates which pierce through the cores to the statue.

Management

The foundry is in charge of Mr. W. Allebaugh, formerly with the Gorham Company, Providence, R. I., and is a son of Winfield S. Allebaugh, well known among American founders as the father of statuary founding in America. The father began with the Gorham Company of Providence in 1890 at a time when this class of work was imported from France, and built up an enviable business from which came a great deal

ONTARIO

This statuette, emblematic of Ontario, with hope on her brow and facing the future with serenity and confidence, is of solid silver from the Nipissing Mine, Cobalt, Ont. It contains 350 fine ounces Troy.

—Designed by J. D. Kelly, of Ralph Clark Stone, Limited, Toronto. Modelled and cast by Canadian Wm. A. Rogers, Limited.

of the statuary work to be seen in the parks and public places of Canada and of the United States. Here the son was employed as assistant foreman for some time before accepting the position with Canadian Wm. A. Rogers, Limited. While in this plant he worked on many of the best statues on the continent.

The Foundry

The foundry is equipped with several furnaces of different sizes so that a choice can be made of a proper unit or combination of furnaces according to the size of piece to be poured. The core oven is of necessity of fairly large dimensions in order to accommodate the car carrying the entire set of cores for the piece being made. Heavy iron flasks and electric crane, sand muller and mixer constitute the balance of the equipment in the foundry. The other departments include pattern and model making, chasing and assembling, as well as machine shop.

Silver

As has already been stated, silverware has been the regular line in which the company has been engaged for years, and it is quite in their line to fill an order for a silver statue, although orders of this kind are not common.

In the illustration will be seen a small silver statue about two feet in height. This was ordered by the Department of Mines, of the Ontario Government, to be exhibited at the Toronto Exhibition. It is intended to symbolize the finished product springing out of the crude ore, and all done in Ontario. At the bottom will be seen three blocks of silver ore just as they were taken from the Nipissing mines at Cobalt, Ont., and rising out of these is the image of Glorious Young Ontario, with uplifted arms, and holding in the hands the shield or coat-of-arms of the Province. It was the intention of the Department to destroy it after it had served its purpose but its beauty forbade such sacrilege and it now stands in the main corridor of the Parliament Buildings in Queen's Park.

Other Work.

Besides statuary, there are tablets which are for the same purpose—that of perpetuating the memory of the departed. These tablets are made from very small samples up to those of several feet in height and carrying many names.

(Continued on page 40)

PREPARING THE MOLDS

The preparation of the molds, while somewhat similar to ordinary foundry work, is in a class by itself.

PLATING AND POLISHING DEPARTMENT

QUESTIONS AND ANSWERS

Question.—I have a brass solution which has been idle for several weeks and which now has a density of 28 Be. The solution does not deposit properly, please advise me what to do to correct the bath.

Answer.—Reduce the density of the solution to about 15 Be. or less. Operate to determine results; if color is dull, or variegated, add small quantity of sodium cyanide, or a half ounce of white stick caustic potash per gallon. Would not advise making additions until bath has been tested under current for few hours.

* * * *

Question.—We nickel plate our product in a single nickel salt solution and recently changed our cleaning methods slightly. We now use a small amount of linseed oil soap in our cleaning tank and find that by adding about one-fourth of a pound of soda ash per gallon of cleaning solution we get better and quicker cleaning action. Shortly after beginning the use of this method we noticed an increase in the number of failures from peeling and contrary to our expectations the condition does not improve. Please note that we get better cleaning and yet have more trouble from peeling. Can your correspondent unform us of the probable source of trouble and suggest a method which would aid us in producing perfect plating without resorting to the slower methods previously used.

Answer.—We are of the opinion that your difficulty is caused by a film of soap. In all cases where soap solutions are used for the purpose of cleaning metals preparatory to plating, it is necessary to use great care in dipping and rinsing. There are several methods of freeing the metal of the soap film or of preventing the film being carried into the nickel solution. Of these several methods there are two which are in quite general use and which effect very dependable results. One method is to employ both a soaking tank and an electric cleaner. The soaking tank to contain the soap solution, and the articles being cleaned are rinsed in hot water when removed from the soak and before placing in the electric cleaning solution. An article which is immersed in a soap solution will become coated with a hard soap film if taken from the soap solution and immersed in a cold solution or cold water. The hot water rinse if used prior to the electric cleaning frees the surface of the metal from the film and prevents the soap being introduced into the final cleaning solution. To remove the article from the soap solution and rinse in cold water, then in an acid, as in Muriatic Acid, then cold rinse and transfer to nickel solution is almost invariably the step to trouble which is overlooked by many platers. An acid dip, irrespective of its acid concentration will harden a soap film, cyanide will not remove it. Therefore the only procedure remaining is to brush the surface of the article with pumice and water; this however, is unnecessary if proper use is made of clean hot water. Do not use hot water repeatedly, provide an overflow in the tank, inject open end of steam pipe and the soap will not create a more or less concentrated solution of the rinse water as would otherwise be the case. We would not discourage you with reference to use of soap; soap is almost indispensible as a cleaning agent in many plants. The linseed oil soap such as you are using is not in general use, but if you find it serves your purpose we advise continuing its use. Whale oil soap is quite popular as an addition to solutions used for cleaning brass, copper, etc., it is a very strong soap and "wears" well in a solution. Sodium Silicate, or what is commonly called "water glass" is also quite generally employed for the same purpose. But irrespective of the brand or form of soap used, the method of preventing the soap film remaining on the surface of the article to be plated remains practically the same. Some platers use two electric cleaners, the second consisting of merely a mild cleaning compound, and the reason for using it being to ensure a film-free surface suitable for acid dipping. Do not operate the soap solution too dense in soap. This is a mistake often made. The solution should show little, if any, signs of the soap content upon the surface. Too dense cleaning solutions are expensive sources of many difficulties.

* * * *

Question.—I am employed by a firm which is governed to a great extent by orders issued from the head office in the United States. If they use a certain formula for alloying metals, or plating solution, we of the Canadian branch must use same formula. This idea may work alright in the foundry, but, I am convinced that we can easily excell their nickel plating. The latest bone of contention appertains to nickel plating small brass castings and stampings which are used in Radio receiving sets. Binding posts, screws, washers, contact pieces, etc. The instructions we have received reads:—"Machine plate durably, as these pieces are subjected to constant wear and abuse." My experience with machine or barrel-plated products has been such as to cause me to doubt very very much the practical possibility of depositing a durable coating of metal upon another metal by means of rotating machine or barrel. I am quite anxious to learn the truth and will adopt the method if convinced it will prove satisfactory.

Answer.—The majority of metal parts used in constructing radio receiving sets may be nickel plated by means of rotating cylinders. The thickness of the deposit and its wearing quality will depend upon several conditions of the bath which must be controlled by the operator. To obtain a heavy matte deposit suitable for subsequent buffing operation, operate the machine at slow speed, solution concentrated and hot. Duration of plating should be at least twice the time usually required for still plating. To obtain a bright lustrous finish, rotate the cylinder rapidly, about 25 r. p. m. should be sufficient, solution concentrated and at room temperature; use about 3 oz. Boric Acid per gallon. Duration of plating should be at least 3 times the period given still plating.

To eliminate the buffing operation mentioned in respect to first method, transfer the articles to a burnishing barrel and burnish with steel balls in a neutral soap solution, or, use a very weak solution of nickel salt to obtain the desired bright surface. It is advisable to remember three points with reference to treating brass goods in bulk by means of rotating machines, in order to avoid the unnecessary rounding of corners and edges—use effective solutions, load according to speed and weight of work; do not burnish longer than necessary to produce desired finish. We would suggest the use of a two or three-speed rotating cylinder, large pieces to be machine plated as described above, by slow rotation, and ball burnished, small pieces to be finished in one operation in the rapidly-rotated cylinder. Manufacturers of plating machines often make ridiculous statements respecting the time required to obtain a good deposit from rotating cylinders. Usually the time given for brass is from 20 to 30 minutes. Our experience of many years operation of plating devices of various types has convinced us that a 20 to 30-minute deposit of nickel on brass obtained in any plating cylinder is merely a thin film which will not withstand any appreciable wear. A deposit of 1 to 1½ hours is necessary if a really durable coating is required.

* * * *

Question.—We wish to electro-plate a tubular piece of steel which forms one portion of our product, with some metal to prevent corrosion. Lead has been advised and we have done some experimenting with this metal. The steel surface has a sand-blasted finish and we find that the lead does not cover sufficiently well to afford the protection we desire. We obtain very satisfactory results on smooth-polished surfaces, but, we wish to use the sand-blast finish if possible. Any suggestions you may furnish us will be appreciated.

Answer.—When lead-plating a sand-blasted steel surface it is advisable to copper plate the steel previous to lead-plating; the copper reaches the depths and furnishes an ideal surface for lead deposit. Lead is not an ideal metal for protection of steel as it has the disadvantage of accelerating corrosion in case of exposure of the steel base. We advise use of a neutral or alkaline strike and then finish the deposit in an acid lead solution.

* * * *

Question.—For several years past I have noticed that each fall my nickel solutions undergo a very remarkable change. This change takes place quite gradually and to a less observant person it might appear to occur suddenly during the first period of cool weather. Some of the more easily detected changes are that deposits appear darker, almost grey, peeling occurs, plate becomes harder, sometimes brittle. I have tried many times to correct the condition and avoid the results but have only partially succeeded. I shall greatly appreciate any assistance you may extend me at this time, and I believe there are many other platers who have similar conditions to contend with, possibly because of a similar source of trouble. I shall watch your columns for a reply.

Answer.—Your difficulty is the result of increased concentration due to solutions becoming cooler as the fall weather advances. The difference in the natural or room temperature of some nickel solutions is often 20 degrees. This depends on the location of the plant and the artificial heating facilities. A difference of one half this figure would cause a very noticeable change in the appearance of the deposit and also in the physical properties which would only be revealed by tests. To obtain results which will prove to be approximately uniform during the different seasons, make a note of the average temperature of your solutions when in prime working condition during the summer season. When cool weather arrives and the temperature of the solutions falls several degrees below normal, procure sufficient black iron ¾ inch pipe to enter the tanks at one end and extend within six inches of the bottom along the entire length and out at opposite end, connect this pipe with the steam supply by means of rubber hose and exhaust the steam into a receptacle containing water, placed at end of the tank. A valve to control steam supply should be placed at point where hose is attached and also at exhaust end. If possible use exhaust steam or steam at low pressure. It would prove advantageous to instal a reducing valve in high pressure steam line if low pressure were not possible otherwise. We would not advise use of this idea with high pressure steam. Passage of steam through the solution each morning in this manner will enable you to maintain temperatures which will result in practically uniform plating conditions during the entire year.

HISTORY OF LOAM MOULDING

(Continued from page 23)

tached to the base, having wrought, or cast-iron pins cast into it, this grid serving to hold all those portions of the loam and sand which project on account of pipes, bosses, etc. This part of the grid would have the interior filled with coke, so as to form a vent for the gases. Care must be taken to see that there is at least 2½ in. of loam, in addition to ¾ in. layer of sand. This part of the mould is swept up by means of a conical pointed spindle, the bush of which is fixed on to the base (No. 18) at the joint shown by line A. A.

The body of the mould is built up of red bricks and loam bricks on a frame (No. 3), which carries the main body of the mould. This main body forms, following the lines B. B. and C. C., a joint with the top part covering the steam-chest, the outer flange of the steam-chest and the top flange of the cylinder. A collar of the same shape as that shown at No. 3, but thinner, is placed underneath the top flange so as to strengthen the mould.

The riser part is made on a grid with pins (No. 4). The steam-chest is then formed along the lines D. D. This part of the mould is made to pattern, and after being marked out and filed to fit the parts of the mould above and below, the thickness of sand left by the pattern is placed in position. The steam-chest is made on a plate (No. 5) fitted with a grid (No. 6). The inlet and exhaust port cores are made in false moulds of loam (tarred when there are many cores to be made). All these parts of the mould are made separately, so that the work can be quickly carried out.

Coring Up and Preparing the Runner

The baseplate is placed level and in a position which allows free access all round. The body of the cylinder mould is placed on the baseplate exactly central, and checked to the datum lines which are marked out when these two part were tried together before blacking up.

The inlet and exhaust port cores are fitted in the steam chest core, and after making sure that they are correctly located they are fixed by means of small bolts (as shown in the illustration). All being fixed, this part is removed by two lugs in the coreplate (No 5) and we thus have the steam-chest, as shown in the vertical section drawing. There remains little difficulty in fixing this securely in the body of the mould.

Having made certain that all is in place, a wedge (No. 7) is inserted between the coreplate and the lower mould grid. By this process it is possible to examine the position of each part of the mould, and to correct it, if necessary. The barrel core is then introduced, and it is easily seen if it makes a good joint with the port cores, etc.

There only remains the header, which is placed in position last of all, after having wedged and bolted up the parts of the mould. It is necessary to replace the closed mould in the stove, so as to dry the joints which have been luted with wet loam.

Pouring the Casting

The method of pouring is of primary importance for the success of castings of great mass and varying thicknesses. Also, for larger cylinders, the author favors pouring from a single ladle, to ensure homogeneous metal, but through a number of small ingates ½ in. to ¾ in. dia. and in number 12 to 14 for a cylinder of 12 tons weight.

The runners are attached tangentially on either side of the casting (as shown in Fig. 6). They are calculated so as to ensure rapid running (10 secs. per ton). One of the most important factors is to secure the flow of the greatest volume of metal into the casting in the shortest time, but at low pressure.

A cored casting should not be subjected to metal pressure, as the metal circulating under these conditions in the mould will attack the mould faces, whereas if the casting is poured at reduced pressure even a large quantity of metal will flow easily over the mould surface without burning and erosion. In order to reduce pressure, the area of the main runner (Fig. 6, No. 4) should be 30 per cent. less than the total area of runners 1 and 2; for example, the area of runners 1 and 2 is 9,360 sq. mm., less 30 per cent., which equals 6.560, and this corresponds to a main runner 91 mm. dia.

This method has always given the best results, and the author uses it for all castings above ½ ton. The author considers the double tangential runners the best for cylinders, as the circular motion of the metal floats up into the riser all sand, slag, scum, etc. In the bore of a cylinder the metal surrounding the barrel core, if not enlivened by a circular movement, brings about inequalities of temperature, which may give rise to cold shots; sand and slag may stick to the core by the pressure at the surface of the metal, whereas by giving the metal a circular movement it washes the core and mould, and one is certain to get clean metal, which will give a perfect bore.

A Convenient Casting Pit

Fig. 7 represents a pit furnished with plates supported with props. By this system, as soon as the casting is poured, and before the sand hardens, the plates (No. 2) can be withdrawn and the sand (No. 5) may be easily removed, as can the casting. In Fig. 7 No. 1 represents the cast-iron slides; No. 2, cast-iron plates; No. 3, wooden props; No. 4, brackets; No. 5, rammed sand; and No. 6, the mould to be poured.

S. S. MOORE, Managing Editor
F. H. BELL, Editor

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

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B. C. Wants To Compete

"WHY should the legislature have to guarantee bonds to the extent of four million dollars to establish the industry?" asks the Winnipeg Tribune with reference to the proposal to establish a fifteen-million-dollar steel corporation in British Columbia. The paper expresses the opinion that existing steel mills can turn out more steel than the world can use, except for special occasions, and claims that there is more urgent need for a satisfactory supply of domestic fuel. There is something in the contention from the point of view that there is more stability in well-balanced industrial development than in concentrating along lines which overstrain the possible market. In that event something must break or wait. However, it is evident that British Columbia feels itself isolated and dependent as a buyer of iron and steel, and their products, and that there is something that appeals in being in a position to compete. It is pointed out that government aid is conditional upon a full investigation as to the possible supply of raw materials, management and methods of financing and prospects of success. The Western market for agricultural implements and other products, the marine and mining industries, together with export possibilities, combine to make the proposition an attractive one to the British Columbians. The question they are undoubtedly investigating most seriously is, Will the possible market guarantee the success of such an industry at the present time?

Labor Wants More Compensation

DURING the recent labor convention in Montreal, certain extensions to the Workman's Compensation law were recommended. Every worker engaged in the building industry it was argued should come within the scope of the compensation law, and it was held, further, that the compensation should be increased from 66 2-3 per cent. to the full extent of the wage.

This latter proposal represents one side of the question. Judging from the statistics presented in the last annual report employers will hardly take kindly to further increases in that respect. It is unfortunate that a certain amount of prejudice has developed largely as the result of conditions following hard upon the war when much was heard of high wages for poor values, and when there were frequent complaints as to malingering. These abuses are disappearing as workmen recognize their personal and relative responsibilities and as unscrupulous medical advisers are being eliminated. Employers, however, will declare that there is such a thing as reasonable limits.

The extension of the Act in respect to the building industry immediately suggests difficulty of operation, even if changes were acceptable. Some very absurd problems could easily develop, and the operation of the general assessment system to work in with the requirements of the compensation laws might become quite an intricate piece of business. Yet, a great many accidents occur in connection with odd jobs where no person at present admits responsibility. It would seem advisable that there should be some regulation applying to such cases.

Ford Uses Strike Weapon

THERE is considerable speculation among business men as to what may or may not be in the background of Henry Ford's move to close his plant September 16. There is always more or less conversation when Ford does anything and it has always developed that what he proposes to do generally happens, with very little variation. Imagination weaves many fantastic stories around Ford and his plant, his motor car and its future. At the present time there are those who declare that the number of cars actually in stock will make it an easy matter to suspend operations for the time being, and that present labor troubles enable him to present a plausible excuse. Those who have had any business dealings with the flivver magnate, however, do not hesitate to credit him with sincerity in the present instance, and that his position is just so strong that he can deliver quite an impressive demonstration of the significance of a strike on the part of a manufacturer against coal profiteering. He is out to prove that it is a poor rule that has only one application, and if successful he will have done a real service to industry generally.

Safety Lessens Wastage

AT A RECENT safety congress, where methods and policies in the reduction of industrial accidents and fatalities were considered, one fact had particular prominence, namely, that a certain responsibility devolves not only upon the safety engineer, supervisor or foreman, but upon the rank and file of employees themselves. Carelessness in organization and in instruction, it was shown, made for great wastage of life and limb, time and money. On the other hand it is shown that when every precaution is observed, the results proved well worth while and were such as to enlist the co-operation of those concerned. It was easily demonstrated that there was lessened wastage through accidents and compensation costs and that there was not only increased production but lessened costs of production.

It is another instance where employees ignoring old-time practices and prejudices, have developed considerable benefit for themselves by working with their employers rather than merely for them or preferring to recognize no relative responsibility.

The Official Organ Mistake

WITH a lack of foresight which indicates an old-fashioned ignorance of the successful relations between a trade paper and the members of the trade it represents, the Timber Industries Council of British Columbia, comments the Financial Post, has decided to establish a journal of its own and arrangements have been completed under which the Pacific Coast Lumberman becomes the OFFICIAL ORGAN of the Council. The Post goes on to say:

Apart altogether from the fact that the Pacific Coast Lumberman and the Western Lumberman have, in active competition, been giving the lumber trade of the Pacific a splendid service by maintaining healthy relations with the lumber consuming markets and that the manufacturers have now taken a questionable step in taking over one paper to be continued on competitive terms which can hardly be regarded as fair or equitable, is the conclusion born of experience that official organs defeat the very purposes for which they are conducted.

The well conducted trade paper represents various branches of the trade itself as well as the consuming public upon which that trade is dependent. Unless the relations between manufacturer, wholesaler, retailer and consumer are healthy business stagnates. To maintain such relations problems must be continually faced and solved. Many of them are unpleasant, but their solution is the function of the trade paper which is properly serving its field.

The official organ must obviously serve selfishly the interests of the particular branch of the trade which controls it. If owned by manufacturers then wholesalers or retailers will not believe that it serves their interests; if owned by wholesalers or retailers, likewise it is regarded as their man Friday. In no case is the public interest likely to be properly respected. The result is that the official organ is conducted to please the people who are paying for its publication —and they usually pay heavily in the long run—and it is ignored by other sections of the trade with whom there should be co-operation and understanding in the interests of all concerned. Printers' Ink has effectively shown "Why Trade Associations Should Stay Out of the Publishing Business," and the following extracts are from articles which recently appeared in that publication:

When an association starts a periodical and goes out in the trade to solicit advertising, it is asking them to support a paper which is not founded on sound publishing principles.

A few associations decide that the independent papers do not "write them up" often enough and start their own publication so as to insure an unlimited flow of puffery.

The circulation is artifical; this circulation is generally maintained by virtue of the subscriber's membership in the association and is kept up regardless of the editorial merit of the paper.

Advertising in such publications is seldom sold on its merits. Seldom will the clever salesman remove the velvet glove from the mailed fist, but the hard iron of the implied threat is nearly always visible to the discerning buyer.

Such publications are of doubtful advertising value because of the difficulty inherent in the proposition of keeping the editorial contents on a par in reader interest with that maintained by a well-edited, independent paper.

When the lumber manufacturers of the Pacific Coast own their own paper they may expect to have their "fur rubbed the right way," but how can they expect that this is going to improve those relations with the dealers which make for good business and mutual advantage?

Another Co-Operative Failure

THE FAILURE of a wholesale and retail co-operative society in the State of Illinois, as announced recently, adds another to the long list of failures of similar organizations. This particular scheme was more enterprising than others of its kind, in that it involved a wholesale house and 67 branch stores. $80,000, it appears, was paid in as capital, and $385,-000 is represented as borrowed money from the various coal miners' unions, which means that the society has lost $185,000 or a fraction more than $5,000 a month.

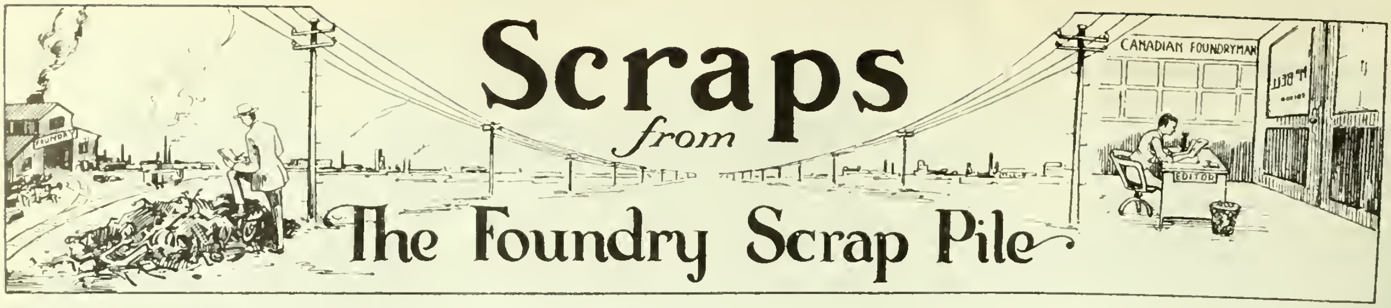
Whether the coal strike has anything to do with increasing the loss recently is not stated, yet it is apparent, says a U. S. exchange, that when the coal miners could not succeed with an evident plentiful supply of money, it is plain to be seen that other attempts with less resources could not hope to get away with it. This has been the history of a great many co-operative grocery stores started in various parts of both Canada and the United States, that have resulted in failures.

Organizations of consumers bent upon reducing the cost of living, who have attempted similar co-operative societies must now be impressed with the success, or rather the lack of it, that attends such ventures. Labor organizations have been especially prone to such attempts to reduce living expenses. It is evident that co-operatives cannot run a store any cheaper than any individual running on the same basis, and the fact that many of these co-operatives are headed by inexperienced managers, makes the likelihood of success even more remote. Members soon learn that prices as between co-operatives and independents do not vary so much, and the latter giving first-class service usually get the greater patronage.

Flirting With Death

THE DEATH of four prominent business men from motor accidents occurring within the short period of three days, to say nothing of the dozens of other minor accidents from motor vehicles directs attention forcibly to the chances which some business men will take when driving motor cars. These men in most cases are heads of important businesses who have achieved their positions through the exercise of caution and wise judgment, yet many of them fail to exercise these same faculties in the operation of their motor cars, oftentimes with serious result. Their endeavor to make up a few minutes' time with excessive speeding compels them to take chances which not only endanger their own lives but those who may be driving with them. It may be that continued neglect to exercise caution in driving may make it necessary for motor cars to be equipped with governors or some other attachment which will curb the present tendency toward excessive speeding on the part of motor car drivers. The lives of pedestrians are endangered as well as those driving in the car, and the community suffers a distinct loss in the premature death of capable executives who succumb to this craze for speed.

Scraps from The Foundry Scrap Pile



The Thomas Davidson Co., Montreal, have just installed a new Sly tumbling mill which finishes out a battery of these mills which was incomplete, at their stove foundry department at Cote St. Paul, Montreal. This department is now running to its full capacity and hopes are entertained that this will continue throughout the year. Mr. A. Dore is in charge.

The Kingston Locomotive Works, the owners of which were reported to be negotiating with the Baldwin Locomotive Company of Philadelphia, for the absorbtion of their plant, is still the property of Canadian Locomotive Company, according to the Kingston Daily Standard, which announced that it has been authorized to say that the plant is not to be sold to the Baldwin or any other company, but will remain under its present control and management.

The International Nickel Co. shipped ten car loads of nickel matte from its plant at Copper Cliff to its refinery at Port Colborne. This matte has been in stock since before the closing of the plant, about a year ago, and is the first shipment to go forward since the plant closed. Despite the fact that the company has a large reserve stock of matte at its plant, the demand is sufficiently encouraging to warrant the blowing in of two furnaces at Copper Cliff before the end of the month.

The Dominion Insulator Company, a Canadian subsidiary of the Cleveland Insulator Company. have begun the construction of their first building at Niagara Falls, Ont. The company have purchased 14 acres of land near the Canadian Niagara power house and will erect a number of buildings. The one now under construction is 80 by 350 feet in dimensions and embodies the latest ideas in factory construction. It will cost $180,000 when completed. 200 men will be employed at the start.

Platinum in paying quantities has been found in the Lianga mines near Manila, Phillipine Islands. Platinum is widespread in the islands, but heretofore it has not been considered to be in paying quantities. The latest tests show 68 per cent. of platinum, which is considered to be rich and well worth developing. Persian capital is behind the venture and a thorough survey is being made to ascertain the extent of the deposits. The one mine is being operated already with satisfactory results.

Cranes Limited, manufacturers of iron and brass pipe fittings and plumbers' supplies, Montreal, are building a city office and show room at 380 Phillips Place. The building is of fireproof construction and six stories high. This company has its plant located in the Cote St. Paul district of Montreal, along the Lachine Canal, and is one of the Canadian foundries which is working at normal, if this is how to describe runnnig full time with a full complement of men, and disposing of the entire output.

The Whiting Corporation, Harvey, Ill., U. S. A., are distributing four catalogues in one parcel, but describing four units of foundry equipment manufactured by this company. No. 161 describes their various lines of ladles, No. 162 describes their tumbling mills, No. 163, their core oven equipment, and No. 164 their trucks and turntables. All the books are profusely illustrated and each describes in detail, all the different types of the line shown. These four catalogues are all at the disposal of anyone who asks for them and will be found interesting and instructive.

The electric steel foundry department of the Thomas Davidson Company, at Cote St. Paul, Montreal, has again started operations after an enforced idleness of some months duration owing to the depression. Sufficient orders are ahead to keep the plant in operation for six weeks, after which it is hoped that plenty of additional orders will be on hand to keep the plant in operation throughout the coming winter. This company has six electric furnaces and can produce any grade of carbon steel. They also have a cupola, which is essential, in conjunction with the electric furnace in the production of manganese steel.

Fire Clay in Saskatchewan.—Fire clay of the very highest and purest grade as well as that of the coarser varieties, is being located in the neighborhood of Lake Wapawekka, 150 miles north of Prince Albert, Saskatchewan. Canada's imports of this material average about ten million dollars per year, and it has usually been considered that this would have to continue, as Canada was supposed to have none of her own. Some of the clay, located was burned and produced a material as white as the best of European china. This can be utilized for porcelain ware, while the coarser brands are quite suited to the requirements of the foundry.

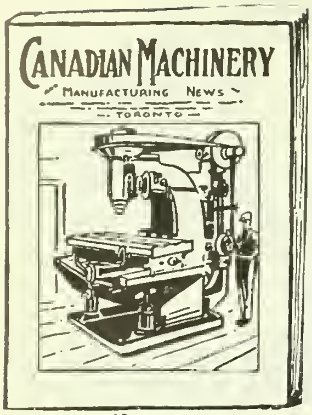
Alldays & Onions, Birmingham, Eng., with office at 40-44, Holborn Viaduct, London, E. C. I, are handing out to the foundry and blacksmithing trade their latest catalogue of equipment which includes vises and vise-benches, bellows, blowers, forges, blast standards, brazing pans, blow pipes, pulley blocks, portable cranes, anvils, swage-blocks, lifting jacks, tire-irons, taps and dies, steam hammers, drill presses, hardening and annealing furnaces, and in fact a full line of equipment for the foundry and smithy, and some tools for the machine shop. Among the larger foundry articles are sand and loam mixers, tumbling mills, standard cupolas, emergency cupolas, receiver cupolas, steel ladles, enameling and core ovens. The book is exceptionally interesting and well worth asking for.

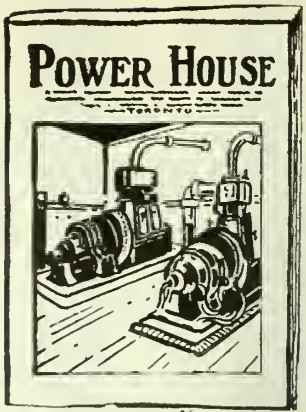
Dust—A loss or a gain? is the title of a new catalogue which the W. W. Sly, Mfg., Co., of Cleveland, Ohio, have just taken from the press and are distributing to those interested in the subject. It describes the dust arrester which has been perfected by this company and shows several installations where it is gathering tons of dust from air which had formerly been considered good enough for breathing purposes. Several testimonials from well-known institutions are published showing that such places as button factories, lime, rubber and other dusty industries as well as the dusty foundry are made fit to work in. Drawings of the interior design of the arrester are shown, making the book of real interest to anyone interested in making working conditions more healthy, while at the same time saving machinery from the abrasive action of the dust which is usually of a gritty nature although in the form of fine dust. The W. W. Sly plant and general offices are at 4,700 Train Avenue, Cleveland, Ohio, with district offices at all parts of the United States as well as Canadian offices at 84 Inspector Street, Montreal, Que., and 48 Abel Street, Toronto. The book is free for the asking.

STATUARY FOUNDING

(Continued from page 34)

They are also cast plain or elaborate according to order. A tablet represents just as careful workmanship as a statue although not, in many respects such difficult work. It is however, even more essential that the work be carefully executed, for the reason that a tablet is usually placed at the entrance to a public building or on the face of a granite monument, but always in a conspicuous place, whereas the statue frequently stands on top of a granite shaft or a tower. However it is all careful work, and all told represents an interesting line of business.





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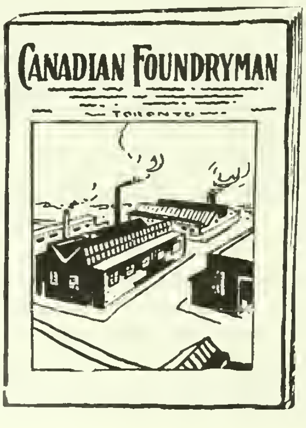

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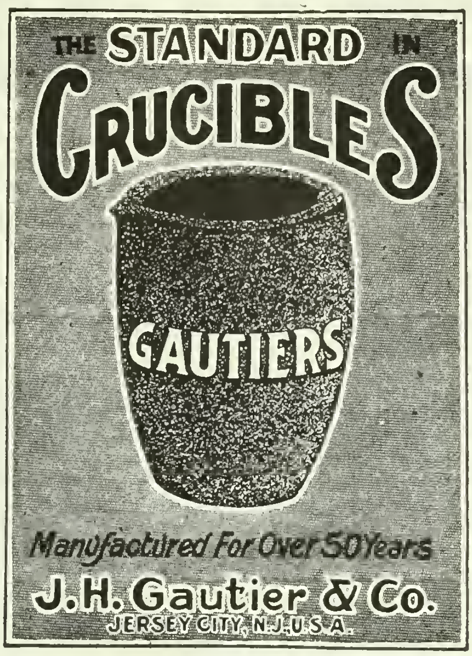

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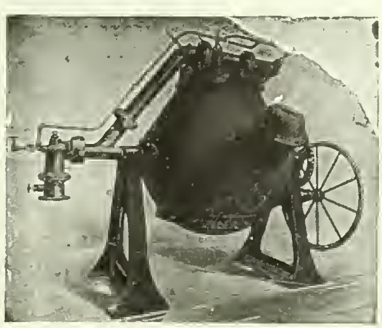
Write us.
LAVA CRUCIBLE CO., OF PITTSBURGH, Pittsburgh, Pa.

Wright High Speed Hoists will do your hoisting quickly, safely, and with little effort. Give them a trial.
WRIGHT MANUFACTURING COMPANY
LISBON, OHIO, U. S. A.

Hawley-Schwartz



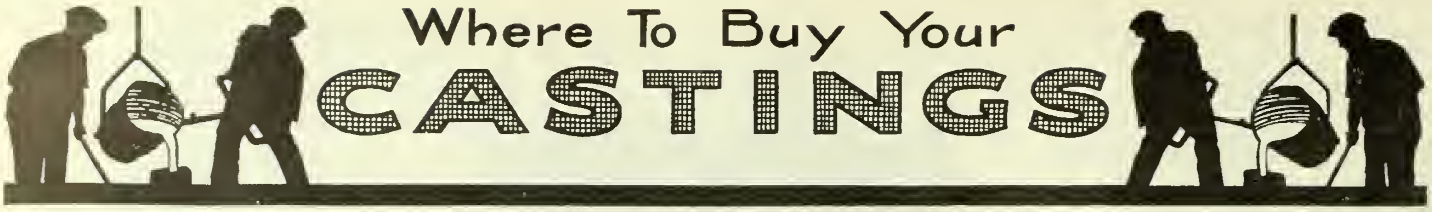
BETTER melts, in less time and at lower costs, are the results that go with Hawley - Schwartz Melting Furnaces. They are economy producers in every sense.

The Perfect Melter

THE Hawley - Schwartz heats uniformly and will handle all metal from 50 lbs. to 10,000 lbs.

Write for catalogue and complete information.

The Hawley Down Draft Furnace Co., Easton, Penn., U.S.A.



The Brown-Boggs Co., Limited
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Grey Iron.

Fisher Motor Co., Limited.
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Die Castings.

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Galt Malleable Iron Co., Ltd.
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Malleable.

S. Vessot & Company
JOLIETTE, QUE.,
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Miller Bros. & Sons, Limited,
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Grey Iron, Semi-Steel Castings up to 10 tons.

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MONTREAL, P.Q. WELLAND, ONT.
Grey Iron Machinery Castings.

Hugh Park Foundry Co., Ltd.,
OSHAWA, ONT.
Grey Iron, Patterns, Etc.

Hull Iron & Steel Foundries Ltd.
HULL, CANADA.
Steel, Manganese, Chrome.

Aurora Foundries, Limited,
AURORA, ONT.
Grey Iron.

Can. Hanson & VanWinkle Co.
LIMITED
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Monel, Aluminum, Brass, Bronze, Grey Iron.

Tallman Brass & Metal, Ltd.
HAMILTON, CANADA
Brass, Bronze, Manganese Bronze, Aluminum.

Dom. Foundries & Steel, Ltd.
HAMILTON, CANADA.
Steel Castings all sizes.

Manitoba Steel Foundries, Ltd.
Office Winnipeg. Works Selkirk, Man.
Steel Castings up to 5,000 lbs.

Brantford Brass Foundry Co.
BRANTFORD, ONT.
Aluminum, Brass, Bronze, Specialty.

The Katie Foundry
GALT, ONT.
Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 7

Machinery & Foundries, Ltd.
BROCKVILLE, ONT.
Light and Medium Grey Iron.

A. F. McCulloch
OSHAWA, ONT.
Brass, Alum. Castings—Wood, Metal Patterns.

Corbet Foundry & Machine Co. Ltd.
OWEN SOUND, ONT.
Grey Iron, Brass.

Fittings Limited,
OSHAWA, ONT.
Malleable, Grey Iron, Brass, Aluminum.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

W. W. Wells
370 Victoria Street, TORONTO, ONT.
Nickel and Monel Metal.

The Robert Mitchell Co., Ltd.
64 Belair Ave., MONTREAL.
Light Grey Iron.

Canadian Steel Foundries, Ltd.
MONTREAL, QUE.
Steel and Ferro-Alloy.

Langley & Austin,
GALT, ONT.
Copper, Bronze, Brass and Aluminum.

Maxwells, Limited
ST. MARYS, ONT.
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The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
Specialty Light Grey Iron.

Lindsay Foundry and Pattern Works, Limited
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Grey Iron and Semi-Steel to 75 tons.

Dominion Engineering Works, Limited
MONTREAL, QUE.
Grey Iron and Semi-Steel to 75 tons.

Smith's Falls Malleable Castings, Limited
SMITH'S FALLS, ONT.
Malleable.

Aluminum Last & Metal Co.,
KITCHENER, ONT.
Aluminum, Brass, Bronze and Special Alloys.

International Malleable Iron Company, Limited
GUELPH, ONT.
Malleable.

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenien e of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Directory of Foundry Supply Houses

The Buyers' Directory of Canadian Foundryman was originally intended to con.ain information regarding lines in the production of which the advertisers actually specialized. We now carry the advertising of leading supply houses, some of whom represent scores of manufacturers, in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the supply houses so we recommend that for all general requirements our subscribers communicate with the supply houses listed below:

The Hamilton Facing Mill Co., Limited, Hamilton, Ont.

Frederic B. Stevens, Windsor, Ont.

The E. J. Woodison Company, Limited, Toronto, Ontario; Montreal, Que.

ANODES, BRASS, COPPER, NICKEL AND ZINC
W. W. Wells, Toronto, Ont.

ARGON
Dominion Oxygen Co., Toronto, Ont.

BRASS FURNACES
Hawley Down Shaft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.

CHEMISTS
Charles C. Kawin, Chicago, Ill.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Indiana

CORE MACHINES
American Foundry Equipment Co., New York City.

CORE OVENS
Damp Bros., Mfg. Co., Toronto, Ontario.
Monarch Engineering Mfg. Co., Baltimore, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.

CORE PLATES
Damp Bros., Mfg. Co., Toronto, Ont.

CORE SAND
Benson & Patterson, Stamford, Ont.
George F. Pettinos, Philadelphia, Pa.

CRANES
Northern Crane Works, Ltd., Walkerville, Ont.

CRUCIBLES
Joseph Dixon Crucible Co., Jersey City, N. Y.
J. H. Gautier & Co, Jersey City, N. Y.

CUPOLAS
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Monarch Engineering & Mfg. Co., Baltimore, Md.

CUPOLA LININGS
Whitehead Bros., Buffalo N. Y.

DUST ARRESTERS
W. W. Sly Mfg. Co., Cleveland, Ohio.

EDUCATIONALISTS
McLain's System Inc., Milwaukee, Wis.

ELECTRIC RIDDLES
Great Western Mfg. Co., Leavenworth, Kansas.
Preston Woodworking Co., Preston, Ont.

FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FIRE BRICK
Bailey & Bell Firebrick Co., Toronto, Ont.

FLASKS, SNAP
American Foundry Equipment Co., New York City.

FLASKS, STEEL
American Foundry Equipment Co., New York City.

FLUXES, IRON, BRASS, ALUMINUM, COPPER
Basic Mineral Co., Pittsburgh, Pa

GRIT AND SHOT, SAND-BLAST
Pangborn Corp. Hagerstown, Md.

LADLES
Damp Bros., Mfg. Co., Toronto, Ont.

LADLE SHANKS
Damp Bros., Mfg. Co., Toronto, Ont.

MAGNETS
Dings Magnetic Separator Co., Milwaukee, Wis.

FLUOR SPAR
Basic Mineral Co., Pittsburgh, Pa.

FOUNDRY ENGINEERS
Austen Company, Cleveland, Ohio.
Charles C. Kawin, Chicago, Ill.
H. M. Lane Co., Detroit, Mich.
McLain's System Inc., Milwaukee, Wis.

FURNACES, OIL
Hawley Down Draft Furnace, Easton, Pa.
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES, GAS
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES COKE
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES ELECTRIC
Pittsburgh Electric Furnace Corp., Pittsburgh, Pa.
Electric Furnace Co., Salem, Ohio.

GRINDERS, PORTABLE
W. Sainsbury, Ltd.
Cleveland Pneumatic Tool Co., Toronto, Ont.

GRINDERS, SWINGING
A. W. Sainsbury Ltd., Sheffield, Eng.

GRIT AND SHOT, SANDBLAST,
Globe Iron Crush and Shot Co., Mansfield, Ohio.

HEATERS
E. J. Woodison & Co., Toronto.

HOSE COUPLINGS
Cleveland Pneumatic Tool Co., Toronto, Ont.

INDUSTRIAL ENGINEERS
H. M. Lane Co., Detroit, Mich.

IRON CEMENT
Smooth-On Mfg. Co., Jersey City, N.J.

KAOLIN
Whitehead Bros., Buffalo N. Y.

MAGNETIC SEPARATORS
Dings Magnetic Separator Co., Milwaukee, Wis.

METALLURGISTS
McLain's System Inc., Milwaukee, Wis.
Charles C. Kawin, Chicago, Ill.

METAL PATTERNS
Bryant Pattern Works, Windsor, Ont.
Hamilton Pattern Wks., Toronto, Ont.

MOLDING MACHINES
American Foundry Equipment Co., New York City.
Benson & Patterson, Stamford, Ont.
Herman Pneumatic Tool Co., Pittsburgh, Pa.
Tabor Mfg. Co., Philadelphia, Pa.

MOLDING SANDS
Whitehead Bros., Buffalo N. Y.
Benson & Patterson, Stamford, Ont.
Geo. F. Pettinos, Philadelphia, Pa.
Venango Sand Co., Franklyn, Pa.

OXYGEN
Dominion Oxygen Co., Toronto, Ont

PATTERN MAKERS
Bryant Pattern Works, Windsor, Ont
Hamilton Pattern Wks, Toronto, Ont

PIG IRON
A. C. Leslie & Co., Ltd., Montreal, Steel Co., of Canada, Hamilton, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto, Ont.

PULLEYS
Dings Magnetic Separator Co., Milwaukee Wis.

RIDDLES
Great Western Mfg. Co., Leavenworth, Kansas.
The Preston Woodworking Machine Co., Preston, Ont.

SAND
Benson & Patterson, Stamford, Ont.
George F. Pettinos, Philadelphia, Pa.
Venango Sand Co., Franklyn, Pa.
Whitehead Bros., Buffalo N. Y.

SAND CUTTING MACHINES
American Foundry Equipment Co., New York City.
H. L. Wadsworth, Cleveland, Ohio.

SAND MIXERS
Philips & McLaren Co., Pittsburgh, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
National Engineering Co., Chicago, Ill

SAND SIFTERS
Great Western Mfg. Co., Leavenworth, Kansas.
Monarch Engineering & Mfg. Co., Baltimore, Md.
National Engineering Co., Chicago.
The Preston Woodworking Machine Co., Preston, Ont.

SAND BLAST HELMETS
Pulmosan Safety Equip. Co. Brooklyn,

SAND BLAST MACHINERY
American Foundry Equipment Co., New York City.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio

SAND MULLERS
National Engineering Co., Chicago, Ill.

SAND BLAST ABRASIVES
George F. Pettinos, Philadelphia, Pa.
Globe Iron-Crush & Shot Company, Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND RAMMERS
Cleveland Pneumatic Tool Co., Toronto, Ont.

SHOT AND GRIT, SAND-BLAST
Pangborn Corp Hagerstown, Md.
Globe Iron Crush and Shot Co., Mansfield, Ohio.

SNAP FLASKS
American Foundry Equipment Co. New York City.
Damp Bros., Mfg. Co., Toronto, Ont.
Diamond Clamp & Flask Co., Richmond, Indiana.

SNAP FLASK JACKETS
Damp Bros., Mfg. Co., Toronto, Ont.

STEEL BANDS
Damp Bros., Mfg. Co., Toronto, Ont.

TUMBLING BARRELS
R. MacDougall Co., Galt, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio

VALVES
Cleveland Pneumatic Tool Co., Toronto, Ont.

WELDING AND CUTTING SUPPLIES
Dominion Oxygen Co., Toronto, Ont.

WINDSOR and DETROIT

E. S. Bryant Pattern Works, Ltd.

WOOD AND METAL PATTERNS

201-203 Glengarry Avenue, Windsor, Ont.

PHONE 5150

Special attention given to Construction, assuring best Foundry and Machine Shop results.

Patterns!

Phone Adelaide 5439

Put your pattern problems in our hands. Quality work and prompt service assured. Patterns made for all foundry purposes—wood and metal, models and aluminum plate work.

The A. J. HAMILTON PATTERN WORKS

120 Adelaide Street West, Toronto

AMERICAN

- Molding Machines
- Charging Buckets
- Dust Arresters
- Sand Cutters
- Snap Flasks
- Pattern Compound
- Core Machines
- Oven Trucks
- Steel Flasks
- Sand Blast

A EQUIPMENT

AMERICAN FOUNDRY EQUIPMENT COMPANY

366 Madison Ave., New York City

NORTHERN CRANES

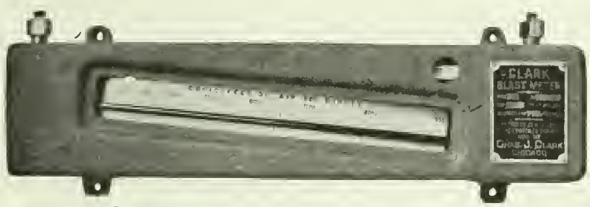
MADE IN CANADA

1 TO 150 TONS CAPACITY

ELECTRIC HOISTS

AIR HOISTS

NORTHERN CRANE WORKS LTD.
WALKERVILLE - ONTARIO.



THE CLARK BLAST METER

indicates the number of cubic feet of air or gas passing per minute.

The Meter is furnished in any capacity desired, each one built to order and guaranteed in every respect. Several hundred are in use in smelters, steel works, coke plants, etc.

Booklet cheerfully sent—write for it.

CHAS. J. CLARK BLAST METER CO.
Gladbrook, Iowa.

Pulmosan Sand Blast Helmet No. 30

Well ventilated, adjustable frame fits any size head. Light in weight and will stand hard wear.

Send for descriptive circular

PULMOSAN SAFETY EQUIPMENT CO.
45 Willoughby Street
Brooklyn, N.Y.

PHILLIPS & McLAREN CO.

Sand Mixers-Grinding Pans

of all types and sizes for mill and foundry use. Also Jaw Crushers.

24th and Smallman Sts.
Pittsburgh, Pa.

ANGULAR GRIT

SCIENTIFIC METALLIC BLASTING ABRASIVE

Trade Mark

Adopt metallic abrasive instead of sand. Angular Grit will reduce your costs — one hundred pounds of grit will outlast five tons of sand. It cleans faster, requires less handling and less storage space, and reduces dust 80%. Write for samples.

Pittsburgh Crushed Steel Co. Sole Manufacturers

PITTSBURGH, Pa., U.S.A., Established 1888

Canadian Representatives: WILLIAMS & WILSON Ltd., Montreal, Canada

INDEX TO ADVERTISERS

Foundrymen!
Turn to page 44 without fail.

To keep an even balance with the particular, on the one hand and the peculiar, on the other, is something of an art; Stevens' Plumbago (direct from India) is doing just that.

It is suiting the most fastidious.

When you question that, in the least, send for a free working sample and prove my assertion. State the class of molds, whether for cylinders, for flat or raised and indented surfaces like ornamental Stove Plate and your prescription will be filled.

My warehouses are filled with good stocks of Foundry Equipment and Supplies; Electro-Plating Equipment and Supplies for I not only manufacture Foundry Facings, but, also Buffing Compositions and Brass Foundry Supplies.

Canadian shipments made from warehouse at Windsor, Ontario, thus avoiding all bother to the buyer from Custom House details.

STEVENS' STAMPED STEEL LADLES

All sizes in warehouse stock, from 60 lbs. to 250 lbs. capacity, each ladle is stamped from a single piece of **steel.**

FREDERIC B. STEVENS

Manufacturer of Foundry, Electro-Plating and Polishing Supplies and Equipment

Cupola Blocks, Fire Brick and Clay

Corner of Third and Larned Streets
DETROIT, MICH.

Or order from the nearest branch
CANADIAN BRANCH: Windsor, Ont.

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CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England.

Vol. XIII Publication Office, Toronto, October, 1922 No. 10

Your fastest man shoveling at top speed could not keep The Wallace Electric Sifter working at full capacity.

The New Wallace Electric Sifter Will Sift a Ton of Moist Molding Sand in Four Minutes

The Wallace Sifter has a greater capacity than any other type sifter known. One ton of moist molding sand can be sifted in four minu'es through a No. 2 riddle and the sand delivered clean and in perfect condition. This will give you an idea of what savings in time you can secure.

The Wallace Electric Sifter (formerly known as the Sand Hog) can be hung from any support at any height and because of its light weight every molder can easily move it to sift over his sand pile or directly into trays or flasks.

An electric motor with patent rotary eccentric housing imparts an extremely rapid vibratory motion direct to the screen, thus maximum sifting capacity is obtained without any loss of power.

You'll appreciate the Wallace Electric Sifter for it'll satisfy your workmen and conserve their time for other work.

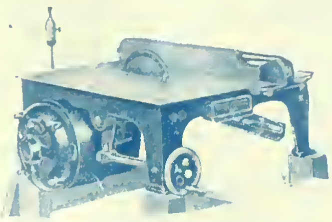
Send for Bulletin 214-S and Price List.

J. D. Wallace & Co.

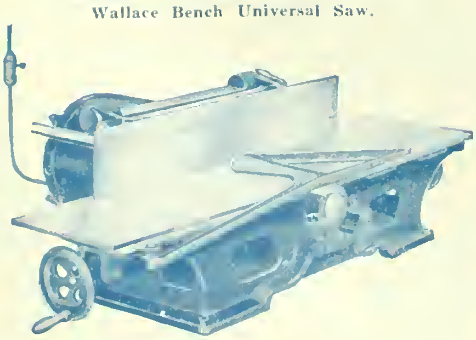
1414 W. Jackson Blvd. Chicago, U.S.A.

Most all machinery dealers handle the Wallace Line

Wallace Bench 16" Band Saw.



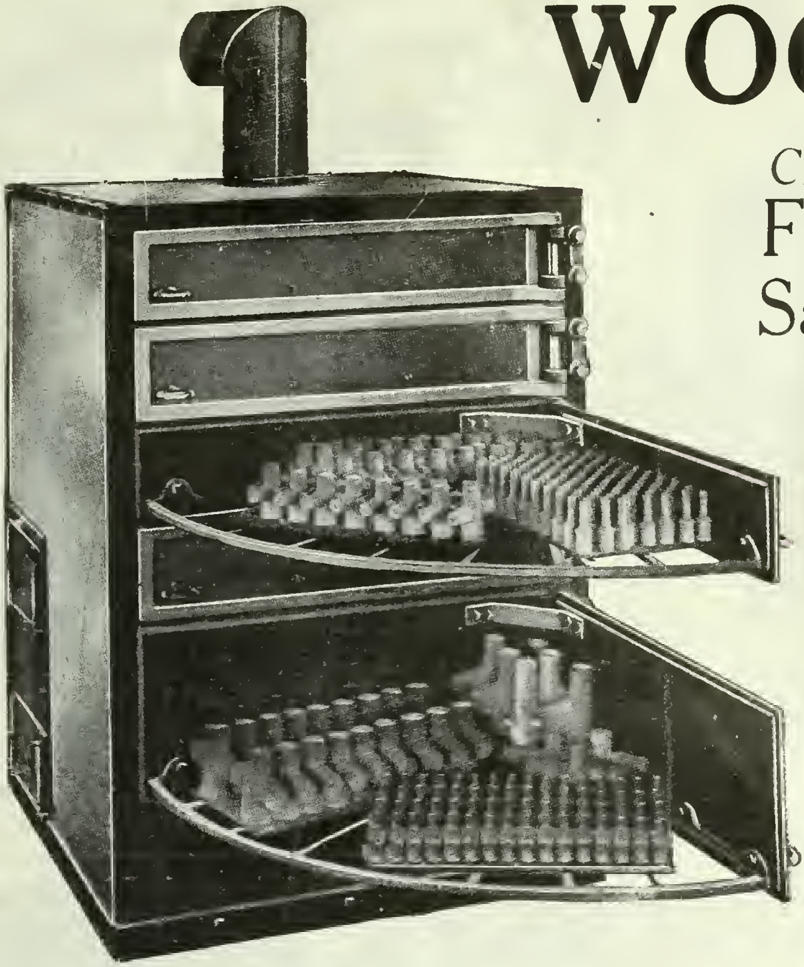
Wallace Bench Universal Saw.



Wallace Bench 6 Jointer.

WOODISON

CANADIAN MADE
Foundry Supplies Save You Money

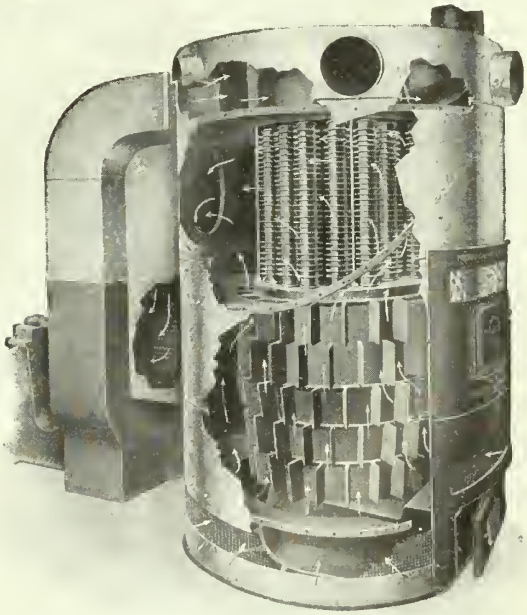


THIS Millett, Patent, Portable, Core Oven enables you at any time to remove the cores on a single shelf without lowering the temperature of the oven, nor in any way hindering the baking process on the other shelves.
Each shelf is made to swing outward and a rear door closes the opening, thereby retaining the heat—a device which means a great saving of fuel. Moreover you get no broken cores with a Millett.

—The—
Only Heater for the Foundry

"More Heat — Less Coal"

At the best, heating the foundry is going to be expensive business this year. Why pay good money to produce heat that's wasted.
Direct your heat to the right spot with this Gordon Heater which is built specially to heat foundries and a great variety of other industries. A multivane fan forces the heat along the working plane, warming every corner and window and insuring your workmen comfort at all times. It does this at a great saving of fuel and a maximum temperature variation of only five degrees.



The E. J. Woodison Company, Limited

Fire Brick - Fire Clay - Heat Proof Cement - Foundry Equipment

588 Dupont Street
TORONTO

261 Wellington Street
MONTREAL

LOOK FOR THIS LABEL

BUFFALO BRAND Vent Wax is naturally affected by heat and cold. That you may get best results from its use we have adopted a designating label on each spool as follows:

SOFT
Wax For
Cold Weather

This wax is for Winter use. It will be more pliable if kept at a temperature over 30 degrees

MEDIUM
Wax For
Moderate Weather

This wax is intended for use in Spring and Fall

HARD
Wax For
Hot Weather

While made for Summer use, this wax should not be exposed to extreme heat.

Each grade of wax is made for use in the season of the year as indicated on the spool. Follow these suggestions, and you will eliminate a lot of trouble.

Regulate your stock so that you will be using seasonable wax. Order more often—in smaller quantities.

A good way is to place a blanket order for shipments at regular intervals—weekly, monthly—as you require. This method insures seasonable wax at all times.

Your supply house can furnish seasonable wax—insist upon it.

UNITED COMPOUND CO.

228 Elk St. Buffalo, N. Y., U. S. A.

DIAMOND

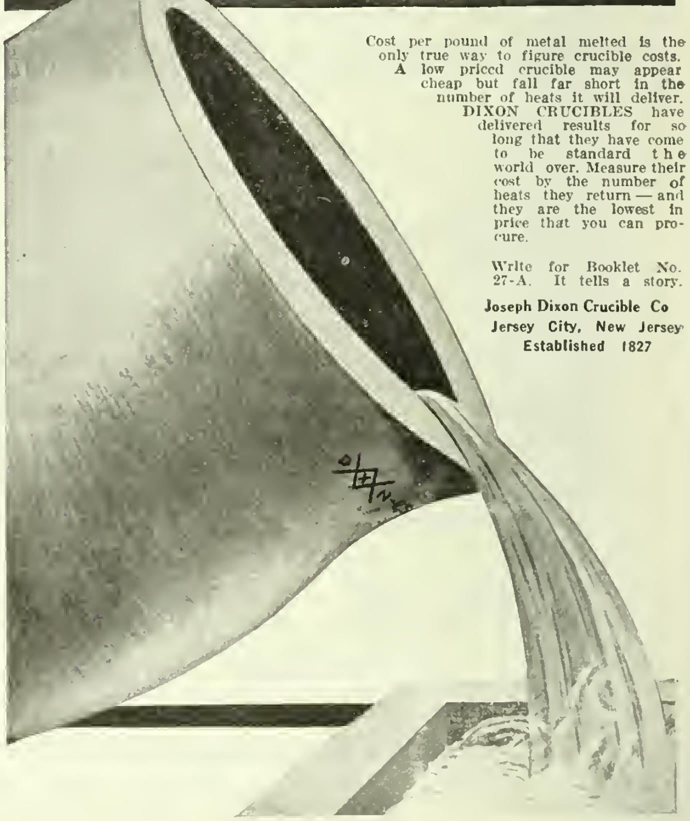
MASTER FLASKS are designed to meet present day needs where rapidity and precision of operation are essential. They are flasks you can depend upon — very rigid and all wearing parts amply provided for.

Sold in Canada By
Dominion Foundry Supply Co.; Whitehead Brothers Company; E. J. Woodison Company; Frederic B. Stevens; Hamilton Facing Mills Co., Ltd.

DIAMOND CLAMP & FLASK CO.

40 N. 14th St. RICHMOND, INDIANA

DIXON'S

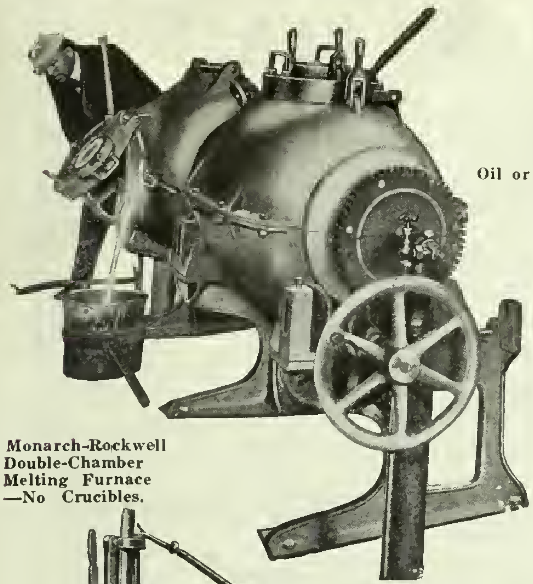


Cost per pound of metal melted is the only true way to figure crucible costs. A low priced crucible may appear cheap but fall far short in the number of heats it will deliver. DIXON CRUCIBLES have delivered results for so long that they have come to be standard the world over. Measure their cost by the number of heats they return — and they are the lowest in price that you can procure.

Write for Booklet No. 27-A. It tells a story.

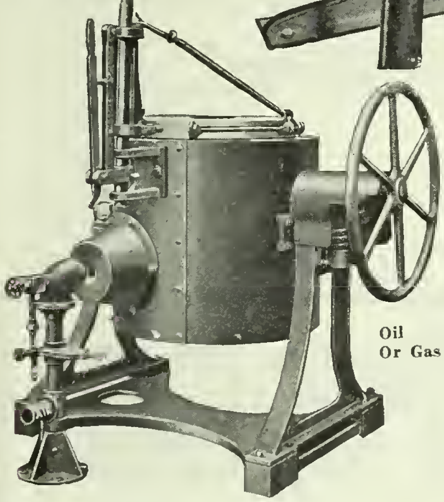
Joseph Dixon Crucible Co
Jersey City, New Jersey
Established 1827

MONARCH FURNACES



Oil or Gas

Monarch-Rockwell Double-Chamber Melting Furnace —No Crucibles.



Oil Or Gas

Monarch Tilting Crucible Furnace. Combustion Chamber Oil or Gas.

Monarch Steele-Harvey Crucible Tilting Furnace, Oil or Gas, Coal or Coke.

Almost Wonderful Results!

BUILT by pioneer furnace makers—by men who have devoted their entire time and energy to the building of these furnaces—the "Monarch" line to-day is saving thousands of dollars in money-making Foundries in all parts of Canada.

3,803,789.29 fluid ounces melted during 1913-14 at a total cost per ounce of $0.002,434 ("Monarch-Rockwell Double-Chamber Furnace) was the experience of the Tonopah-Belmont Mill (Silver).

"Monarch-Rockwell" Double-Chamber Melting Furnaces actually do twice the work in half the time. The exhaust heat from one chamber, instead of being wasted as in other furnaces, is used to bring the metal in the other chamber to near melting point. The wide range of operation made possible by this method will be appreciated. It makes melting practically continuous, permitting melts of various mixtures of metals to follow one another in rapid succession.

The "**Monarch**"—a Continuous Revolving, Non-Crucible Furnace, is a popular furnace—and deservedly so—its continuous rotary motion gives greater length of life to the linings, decreases the melting period and saves labor.

The **"Monarch Steele-Harvey" Crucible Tilting Furnace**, for coke, is substantially built for continued and long, heavy service. Patented revolving grate bars maintain a clean fire at all times; the furnace, being entirely above ground, is easily accessible for repairs and it has a drop bottom of the most approved design. These points are worth appreciating—perhaps more so than the very low first cost of this furnace.

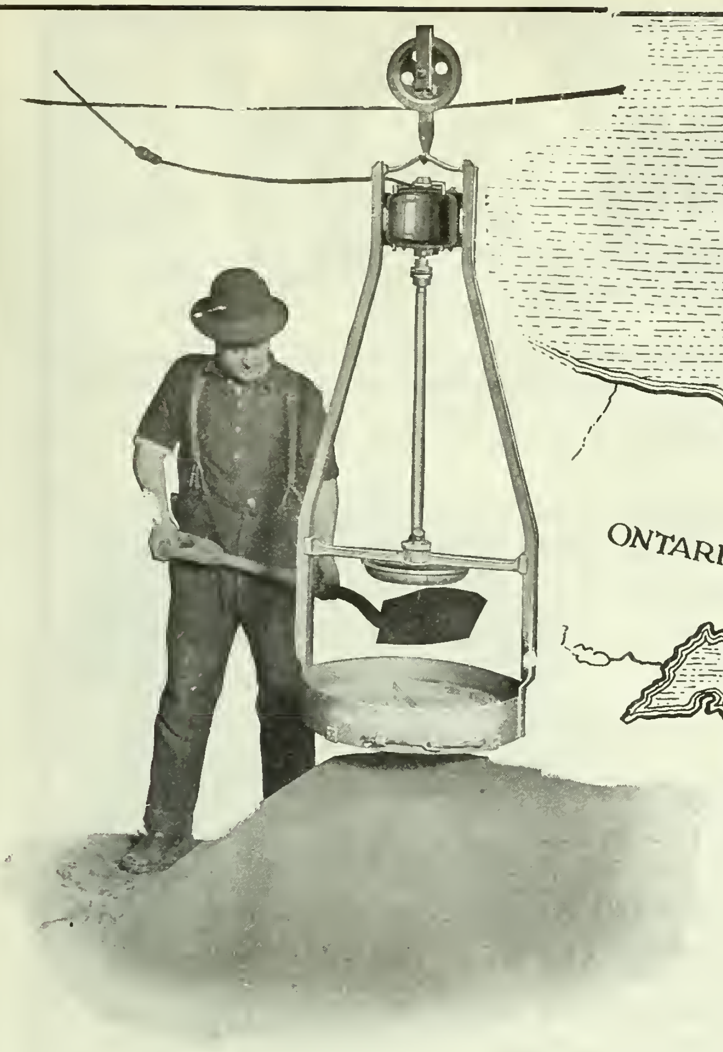
There is a Monarch type for every Metal Melting need.
Send for Particulars.

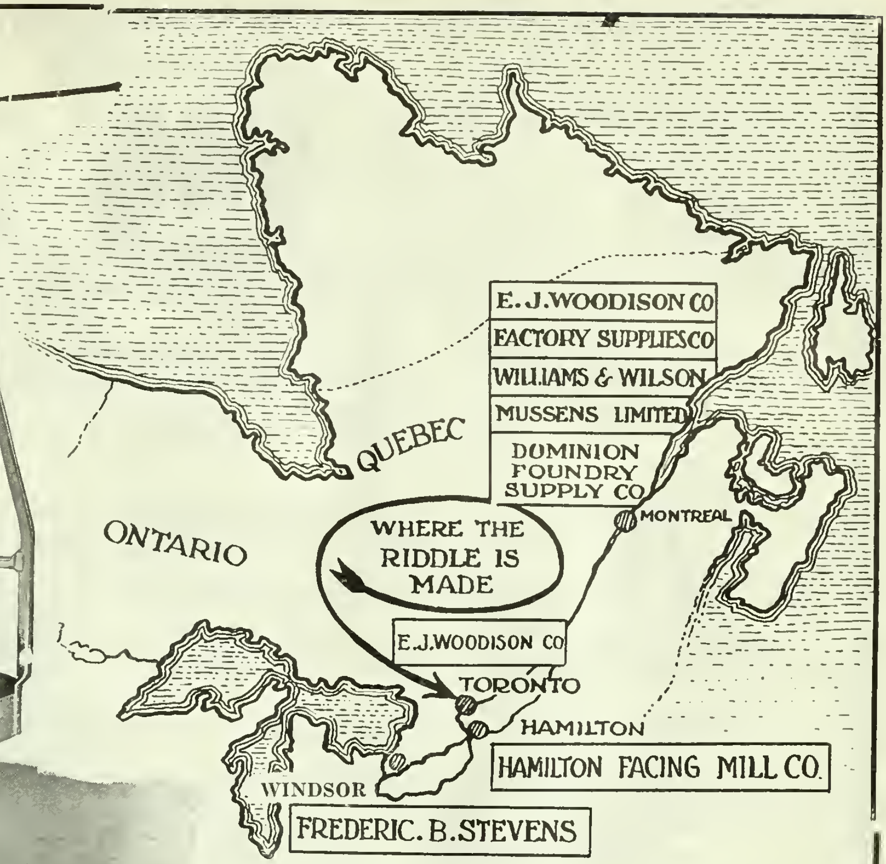
The Monarch Engineering & Mfg. Co.

1206 American Bldg., Baltimore, Md., U.S.A.

Shops at Curtis Bay, Md.

New York Office, 50 Church St.





Doing Without a Combs Gyratory Riddle Means Paying for It Without Getting It.

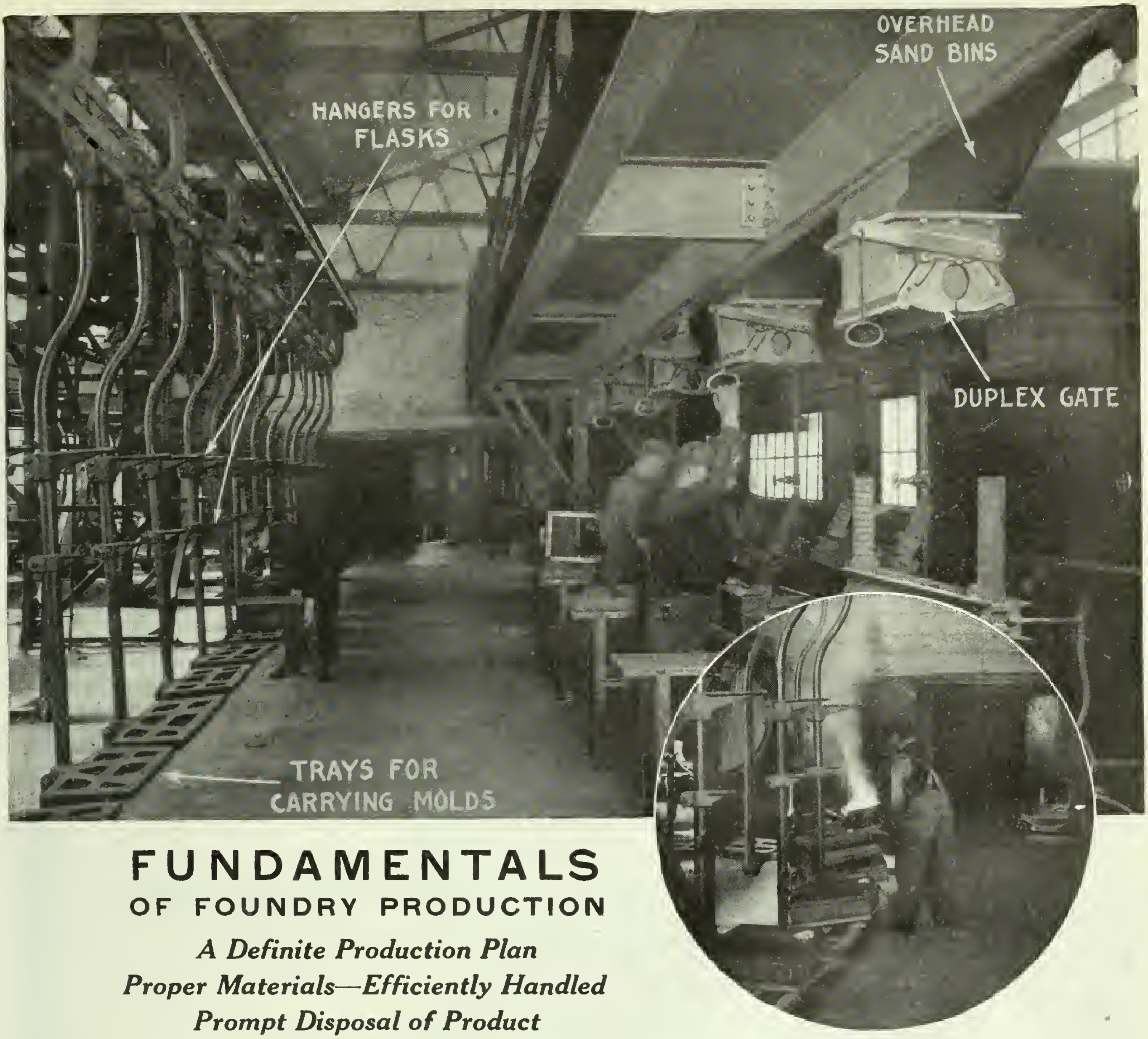
Are You Using Too Many Men?

The time of your employees is the most expensive thing which enters into the cost of castings. Every Saturday night a liberal percentage of your payroll goes for time spent in screening sand. You can shave this sand screening time to the minimum with a **Combs Gyratory Foundry Riddle.** This machine will sift sand faster than one man can shovel into it, and will also screen more sand than ten laborers using hand riddles.

It is in every sense a time saver. Weighing but ninety pounds, a man can easily pick it up and carry it wherever needed, and when suspended from a trolley on a wire cable the Combs Riddle will supply as many as twenty moulders with sand.

E. J. Woodison Co., Toronto.
Hamilton Facing Mills Co., Hamilton.
Frederic B. Stevens, Windsor, Ont.
Dominion Foundry Supply Co., 185 Wellington St., Montreal.

Mussens, Limited, 211 McGill St., Montreal.
Factory Supplies, Ltd., 244 Lemoine St., Montreal.
Williams & Wilson, 84 Inspector St., Montreal.
E. J. Woodison Co., Montreal.
Strong-Scott Mfg. Co., Winnipeg, Man.



FUNDAMENTALS
OF FOUNDRY PRODUCTION

A Definite Production Plan
Proper Materials—Efficiently Handled
Prompt Disposal of Product

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It takes the "guess work" out of tempering the sand, preparing it to a uniformly high standard and conveying it to convenient bins above the machine or bench.

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It performs every operation carefully and uniformly and has made some remarkable records in increasing production.

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CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Member of the "Audit Bureau of Circulations"

Established 1909
Published Monthly

Wonderful Business Developed During Panic

Dominion Engineering Company Broke First Sod on Nov. 23, 1919, and Took Off First Heat on June 10, 1920—Have Run to Capacity Ever Since on Enormous Castings

By F. H. BELL

AS AN example of what foresight, coupled with determination, can achieve, the Dominion Engineering Co., of Lachine, Quebec, stands as a motto for those who were contented to sit idle, under the delusion that a buyers' strike was raging and that nothing could be done until someone else would make a move. Who the someone else was to be, nobody seemed to suggest, so the buyers' strike, if we may call it by that name, continued on through the second year and is, to considerable extent, continuing still.

As every foundryman remembers, the depression began to assert itself during the month of September, 1919, and continued unabated until a very short time ago when things began to pick up. However the field was open and waiting for someone to work it, but this "someone" had to be endowed with pluck, as it was a big undertaking.

Natural Opportunities

Two of Canada's natural resources in which she is unsurpassed, are her enormous water powers and her immense forests of pulpwood. If these must be developed in order to supply the wants of the world, what safer venture could any enterprising Canadian concern undertake than to manufacture the machinery with which to develop them? This machinery consists of paper-making machines and the turbine water wheels with which to drive them. These with other big work such as pumps for water systems, etc., presented an encouraging outlook for the men who were to form the Dominion Engineering Company which was in contemplation.

The Dominion Engineering Company is a subsidiary of the Dominion Bridge Company but organized under a separate charter and with a slightly different personnel. Both are located at Lachine, which is just outside the western boundary of the city of Montreal at the site where the explorer Champlain made his home for a time, and where his compatriots, under the argument that if Columbus had landed at India,

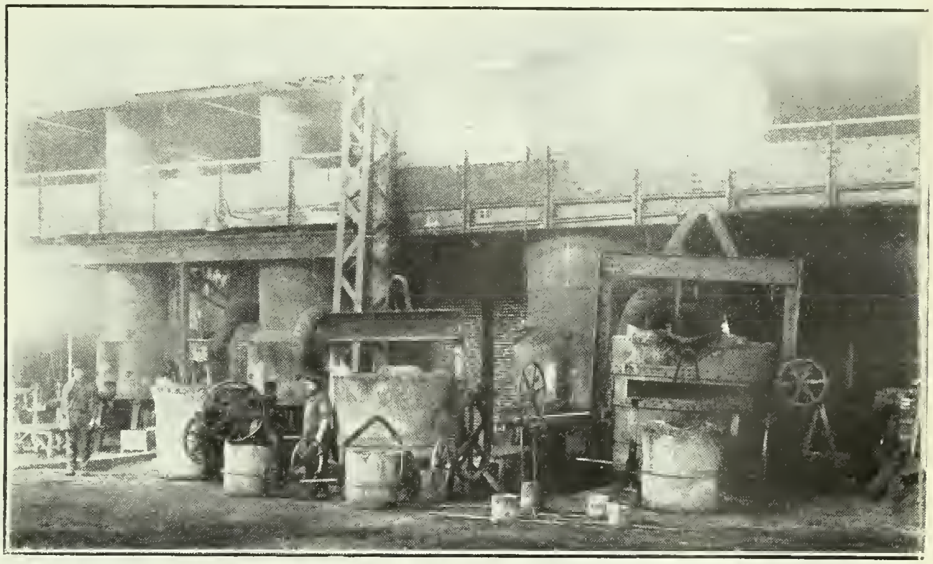


Fig. 1.—Cupolas and Ladle Equipment of Foundry consisting of, One 37", One 54" and One 84" cupolas, giving a melting capacity of 35 tons per hour. Ladles range in capacity from 1 ton to 50 tons each.

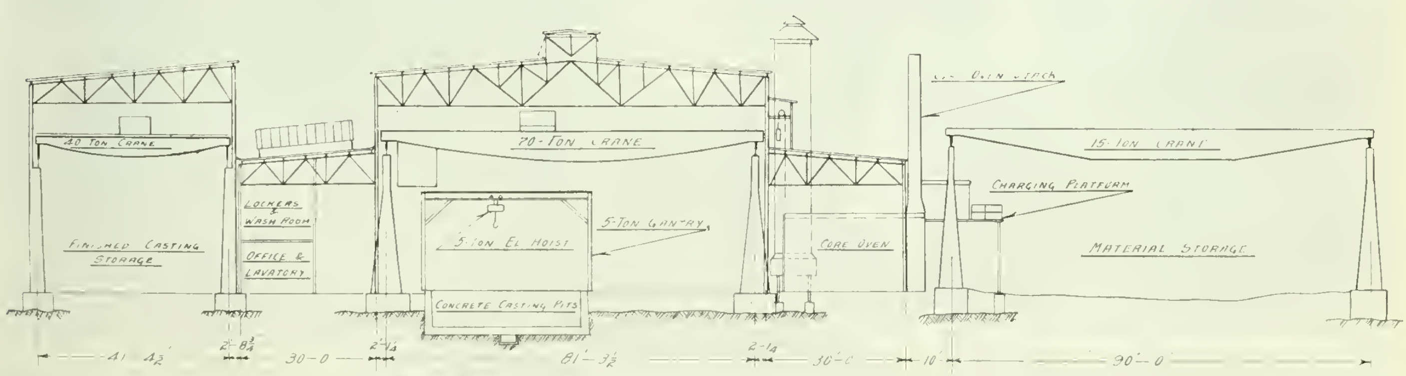


Fig. 2 Shows Cross section view of foundry department, Dominion Engineering Company, Montreal.

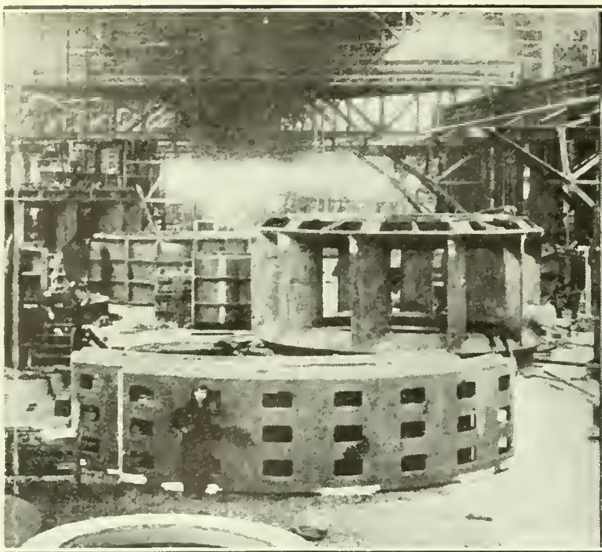


Fig. 3.—Shop view looking West, showing two 11,300 H.P. turbines for M.L.H. & P. Cons., being assembled. Portions of Stator Frame for 41,000 H. P. turbine in foreground. Approx. total weight of 11,300 H. P. unit is 1,000,000 lbs., Stator Frame (in four sections) 100,000 lbs.

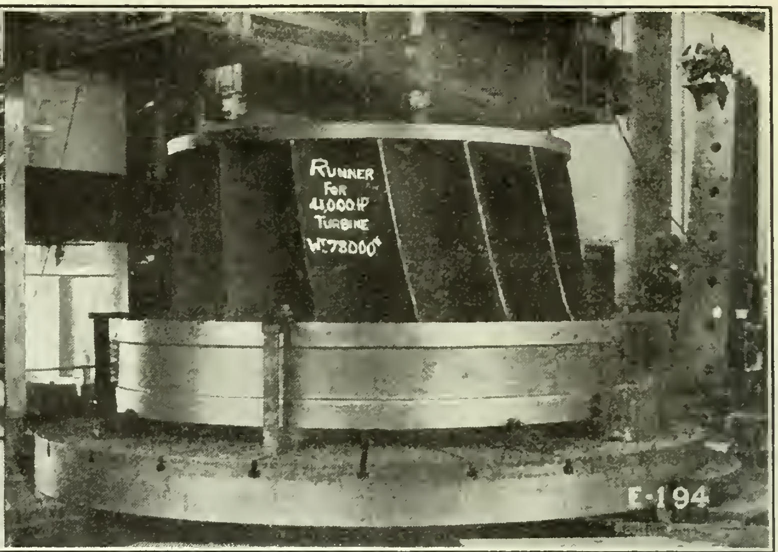


Fig. 4.—Cast Iron Francis Runner, (High Speed Type) of 41,000 H.P., V.S.S.R., turbine for Shawinigan Water & Power Co., Loam casting, total weight, 78,000 lbs.

as he supposed he had, this must be China, jokingly dubbed it "In China" or La Chine, as the Frenchman would say.

Realizing that a demand existed for the class of equipment mentioned, and that while some of it was being done in Canadian plants, there did not appear to be any Canadian manufacturer who cared to venture into an undertaking representing an outlay such as would be required to manufacture a complete line of such machinery, with a determination which their previous experience in big work on bridges and other structural work had endowed them, the directors of this company, began, in the midst of one of the worst depressions in the history of the country, to prepare for the manufacture of the largest sizes of water wheels, paper mill machinery and centrifugal pumps. Any one of these would make interesting material for an article, and I will endeavor to prepare these articles for future use, but for the present I will confine my efforts to the water wheel as it is in probably the heaviest class.

Melting and Pouring Capacity

The illustration, Fig. 1, which shows the cupolas and ladles, will give the reader an idea of how big work would fare in a shop with such equipment. The largest of these cupolas is 84 inches, inside diameter, while the others are 54 and 37, giving a melting capacity of 35 tons per hour. The largest ladle was intended for a safe capacity of 40 tons, but it has already carried 43 tons and if filled to the brim would carry approximately 50 tons.

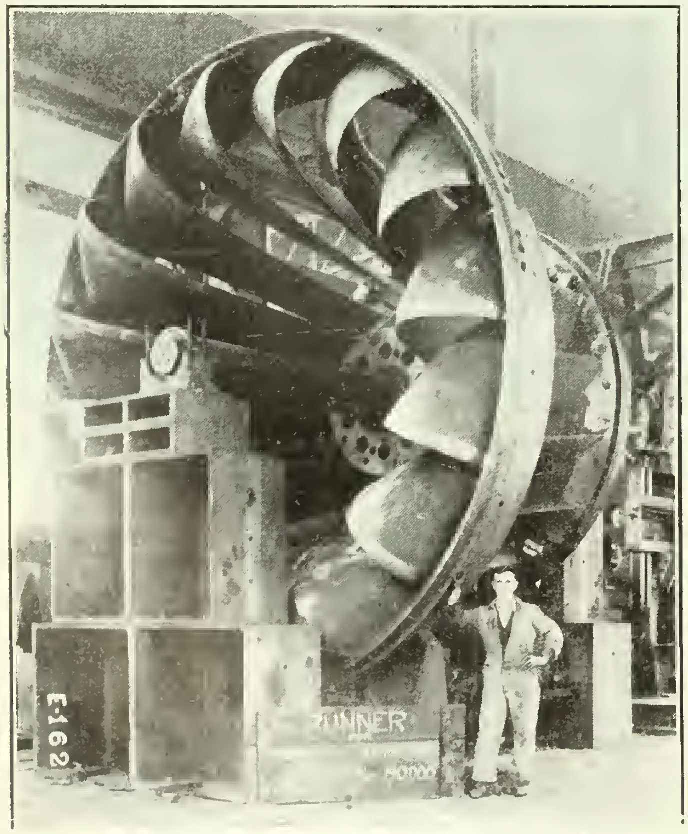


Fig. 5.—Cast Iron Francis Runner, (High Speed Type) of 11,300 H.P., V.S.S.R., turbine for Montreal Light Heat & Power Consolidated. This is the largest runner of this type ever built. Owing to shipping limitations it was necessary to build it in four sections. Total shipping weight, 190,000 pounds.

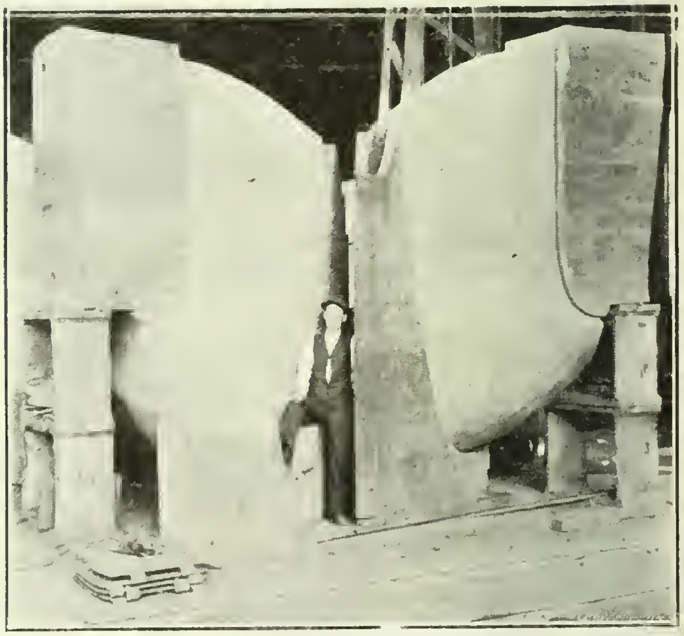


Fig. 6.—Some of the cores for Runner of 11,300 H.P. unit for M.L.H. & P. Cons. Some idea of the amount of core work required may be realized from the fact that each of these cores weighs well over 7 tons and 16 of them are required for one runner.

In Fig. 2, will be seen a cross section layout of the foundry buildings. The 70 ton crane shown is only one of the cranes, as there is another of similar capacity beyond this one and on the same track. These together with the small cranes about the shop make up the crane capacity, which is abundant for the melting capacity. The cranes in the other rooms are for lifting heavy castings and patterns but cannot be utilized in the molding department.

The pits in which the molds are made, are of solid concrete, with binding hooks built in. The molds for most of the big work are made in brick and loam, while the cores are made of sharp sand and core binder, the same as any core. The molds are not necessarily made in the pits, since the crane and oven capacity is sufficiently large to handle the work and place it in the pit when ready. The outside portion of the mold is however usually made in its place for the reason that it can be done more economically than by handling it so much, and it is a simple process to dry the wall with fire baskets. The concrete pit makes an excellent backing for the brick work, while the bottom is unyielding under the heavy pressure of the enormous weight of metal, but many of the molds project above the walls of the pit and have to be reinforced by other means. All of these features I will endeavor to explain.

The Turbine Water Wheel

Before going into the details of molding the parts of a turbine it will be as well to show a few views of the castings after they are made. Some of these castings are for high speed wheels while others are not, so the horse power given for one may be much different from that of another while the castings will be practically the same size. However, from a foundry standpoint there is very little difference in the work to be done, while from the reporter's standpoint it is a difficult matter to get a complete set of castings together

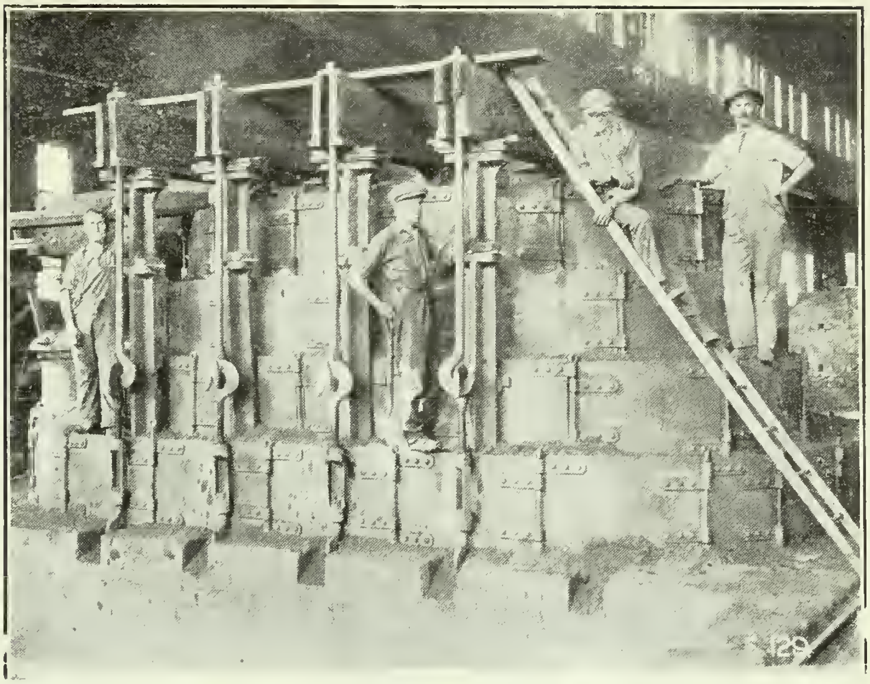


Fig. 8.—Mould for runner section of 11,300 H.P. turbine closed ready for pouring. Attention is drawn to the sectional style of flask.

at one time, but I will try and pick out a set from the different views.

In Fig. 3, will be seen a view taken in the machine shop. This shows different types of wheels but the one which will look the most familiar to those accustomed to seeing the small turbines of former days is the top one in the front of the illustration. Another of these will be seen in the rear. This is what is known as a stator frame, and is the stationary part of the water wheel. The gates which regulate the inflow of water are pivoted in the openings around the circumference. In Figs. 4 and 5 will be seen views of the runner or revolving part of the turbine. This runner which fits inside of the stator frame when in use is the casting that I want to describe, and by seeing it from all angles after being finished the foundryman will have the

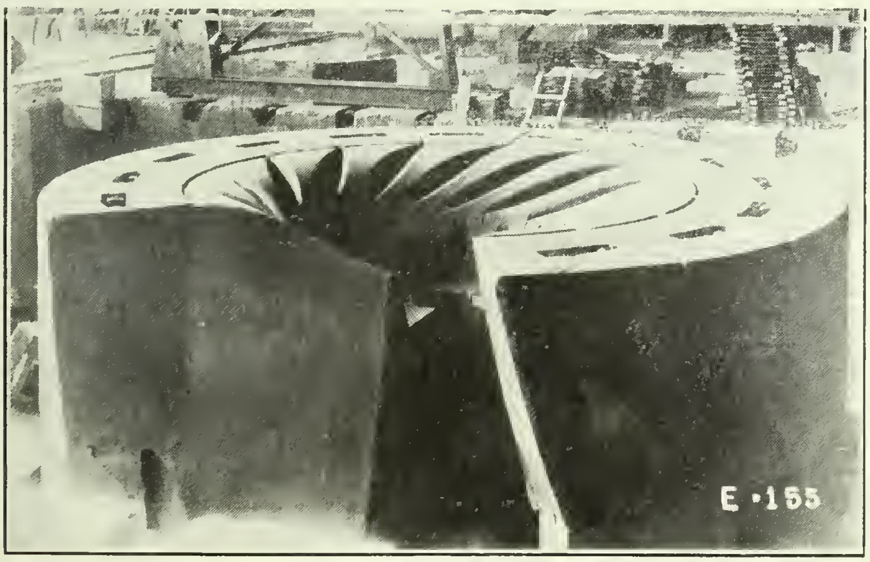


Fig. 7.—View in Foundry showing cores for runner of 11,000 H.P. turbine, being assembled in moulding pit.

opportunity of knowing what sort of a job it was to do. Fig. 4, shows the runner sitting right side up, in the machine shop. The vanes will be seen to be on a slant and somewhat twisted. When in use at the power plant, the water will enter through the gates of the stator frame and pass through these twisted openings. In Fig. 5, will be seen the underside of the runner which gives it a more complicated appearance.

Molding

In foundries where small turbines are cast, it has been common practice to have an iron pattern made in sections and make the entire mold in green sand by using anchors to lift the sand away from the vanes. In other foundries the vanes have been made of sheet metal placed in the mold and the melted iron poured around them. Both of these methods worked all right within certain limits but neither would fill the bill for such wheels as are here described. These wheels or runners are made almost entirely in cores. Figs. 6 and 7 will give an idea of how this is done. Fig. 6 shows some of these cores being pasted together before assembling them in the mold, while Fig. 7 shows a number of cores assembled. It might be explained that the cores assembled as in Fig. 7, was done for photographing purposes, and they show correctly how they would be when completed but this is not the way the assembling is accomplished. In the bottom of the pit are specially prepared tables similar to the jaws of a lathe chuck, on a large scale, on which the cores are placed and all brought together simultaneously, otherwise they could not be brought together at all on account of the twisted shape. When all the cores are assembled they will be

(Continued on page 25)

Pattern Maker's Query—How Shall it be Molded

Should Know How Molding Will Be Done Before Beginning Work on the Pattern. Repetition Work is Molded Differently From Jobbing. Pattern Maker Should Be Governed Accordingly.

By JOSEPH HORNER in Mechanical World

A CONCISE statement of the reasons why one method of jointing and moulding is to be preferred to another may be helpful to apprentices to patternmaking and to the younger workmen. Set rules and repetitive practice sometimes fail when slightly modifying features occur. A workman should always be prepared to give a clear reason why he adopts a certain method of jointing, instead of saying that it has always been done in such a way.

An impracticable method of moulding the bracket, Fig. 1, would be that with the foot uppermost and the bosses downwards. Impracticable, though not impossible, because the bosses A and B would have to be cored over, since they could not deliver by being left loose, and drawn inwards. And provisions would have to be made for their holes with awkwardly located drop prints.

The proper way to mould is in the direction of the arrow, the edge C going down and D in the top. Then the pattern might be made solidly, but better if jointed and dowelled in the plane a—a. The moulder will then carry his joint round to b the centre of the boss. A radius is inserted at c to avoid the undercutting of the boss A. The hole in the boss A can be cored with two drop prints, that in B with a round print on the lower face. The holes shown in the foot are not cored, but drilled. They would cause too much trouble using drop prints.

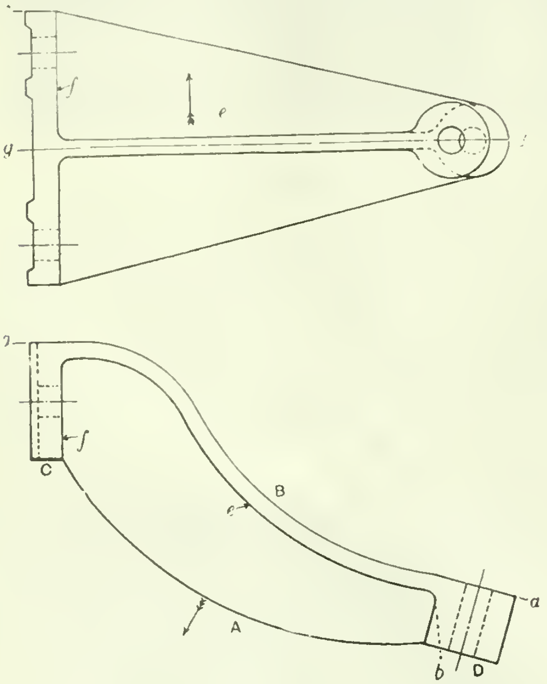


Fig. 1.

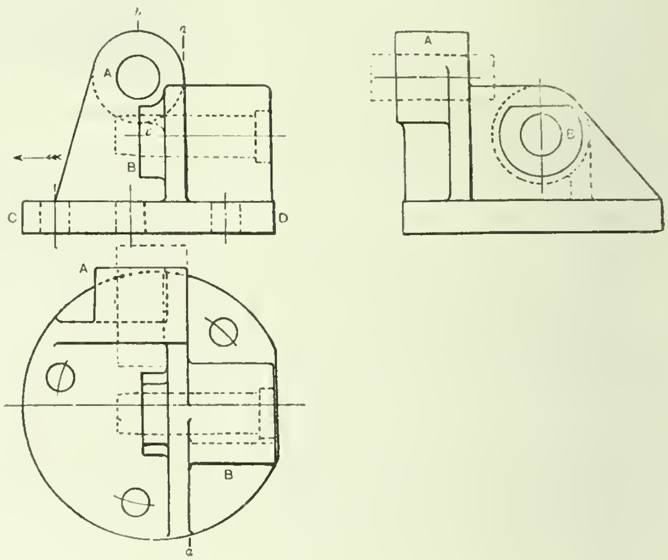


Fig. 2.

The bracket in Fig. 2 can be made to mould in one of three ways, each with little special advantage over the others. The pattern may be made unjointed with the rib A downwards, with a curved sand joint from a to a between bottom and top boxes, so following the curve of the web. If this is done, either the foot C must be left loose or the boss D, because of the undercut of the inner edges of the two relatively to each other. Or a portion of the boss D may be jointed loosely, as indicated at b. The hole in D may be cored with a round print, but it is better if left to drill. The bolt-holes in the foot can be taken out with drop prints, but they will cost more to core than to drill.

The pattern may still be constructed solidly, but moulded sideways, the sand joint between top and bottom going from c to d in the upper view. This is not a good method, because a deep lift of sand has to be made up the inner face e of the web and the inner face f of the flange, against which, the faces being perpendicular and deep, it would become torn up. If the pattern is moulded in this direction it should be jointed and dowelled either along the centre of the web a—b or along its upper face. Moulded thus the planing strips on the foot must be skewered on loosely. I should prefer the first method, described in connection with the lower view, because the width of the web is continuous across its width, being planed to the curvatures and screwed on the rib, and is therefore stronger than if divided in half along the line g—d in the upper view.

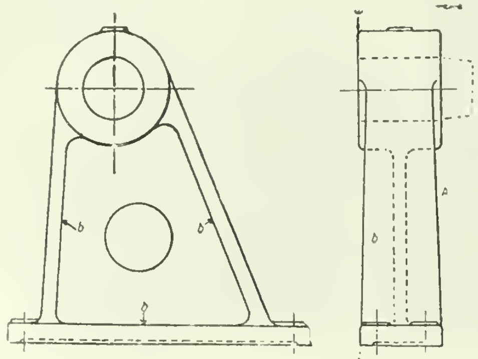


Fig. 3.

There is only one way by which to mould the bracket Fig. 3, that is on its side A downwards. The question of jointing does not arise, because the bounding ribs are shallow. They will deliver if tapered on the inner faces—

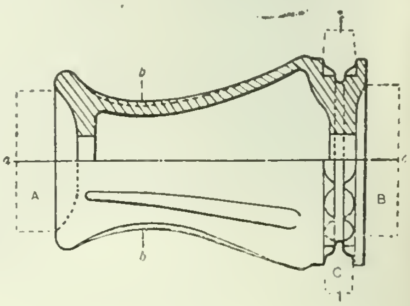


Fig. 4.

say, ⅛ in. in a depth of 3 in. or 4 in. On the outside there is only a very slight taper, or none at all, the rapping being sufficient to loosen the pattern from the sand and ensure a clean lift. The mould joint is made along the face a—a. A round print is put on the boss for the shaft hole. The hole in the web will deliver itself. If separate bosses are fitted for the bolt-holes in the foot they must be skewered on, but a continuous facing can be substituted and made fast. The bolt-holes will be drilled.

But if the bracket were very much deeper the inner faces of the upper ribs would be so deep at b that an excessive amount of taper would have to be imparted to ensure a clean lift. The alternative, then, is that of the upper view in Fig. 2, jointing the pattern along the centre of the web or along the top face of the web. This is adapted in many patterns of which Fig. 3 is typical.

The warping cone, Fig. 4, is a casting that can be made with a choice of several methods, the selection being governed chiefly by the number of castings ordered. The pattern is built up with lagging strips in any case. It may be jointed in halves along the middle plane a—a. In that case, end prints A, B are fitted to take out the undercut portions at the ends, the shaft holes, and the central body of the core. The recess for the chain must be cored, for which an annular print C is turned, and the core is made in halves to go in bottom and top. The ribs—whelps—must be skewered on the pattern loosely, except those which come in top and bottom.

Another way is to divide the pattern along the plane b—b to mould vertically, the prints A and B being retained, but tapered instead of made parallel. The ring print C may be retained, and the core be made as a complete ring. Or if the casting should be large, and only one or two required, short segmental cores can be made and set round in the print impression. Yet another method is to mould vertically, still with a joint at b—b, but instead of coring the portion for the chain, to cut it in the

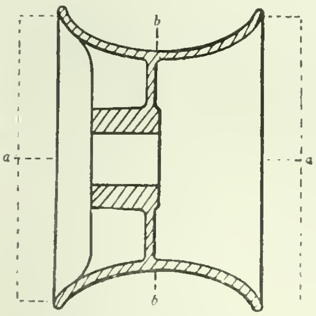


Fig. 5.

pattern. A joint is then made along the plane c—c. This is the best method to adopt when a large number of castings is required. Sometimes for one or two castings of large dimensions a loam-pattern body, undivided, of course, is swept up with the prints A, B, and C included, and the ribs cut in wood and attached to the loam body. The corebox for the chain groove has to be prepared. The central core is swept against the edge of a board.

The warping cone in Fig. 5 is a casting that is differently made, according to the numbers off and the size. The pattern can be parted longitudinally along a—a, with prints at each end. The boss, disc, and ribs will be put in a half corebox. The presence of these would prevent the sweeping of the core on a bar. A large box is expensive. To avoid this the pattern can be jointed along b—b, and the interior left to deliver itself. The objection to this is the flimsiness of the rim built up with segments. This may be avoided by making a metal pattern for the rim alone, and fitting the disc, boss, and ribs in wood; but this presupposes a considerable number of castings required.

Such a method would be nearly impracticable in the shape Fig. 6. This can be jointed along the centre a—a, with prints as outlined. Another way is to mould with the face A downwards, using a tapered print. But the presence of the disc and boss requires a corebox. A little trouble may be saved by joint-

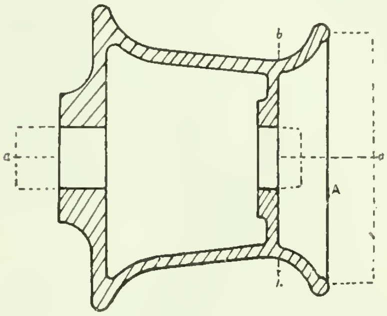


Fig. 6.

ing the pattern along b—b, leaving the inner portion below to deliver itself; put a print on for the small hole, and rest or check the centre core swept up on that. The core for the upper shaft hole can be checked into this with a print impression, or be swept with it.

The coned crane roller in Fig. 7 might be jointed longitudinally, but it would be a poor method, because the metal in the top would be liable to turn out spongy, and these rollers have to be turned, and must be free from honeycombing. The proper way is to mould it with the face A downwards, put a tapered print on the boss there and another on the top boss. The interior is rammed in a corebox, or a half box, the numbers being large, and the cores for the holes B, out of which the main core is withdrawn, are rammed on the main core, or set in print impressions in the latter.

Only one way is feasible of moulding the drum in Fig. 8. Its dominant fea-

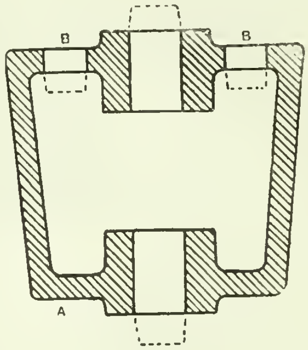


Fig. 7.

ture is the recessed claw clutch at one end, and the ratchet wheel at the other, full shrouded. Both are formed in cores, for which prints are provided as indicated. The ratchet core is made in halves in a half box for convenience of insertion in bottom and top. The pattern is jointed along a—a, and the central core is swept on a bar. The clutch core is threaded on an extension of the shaft core at that end before insertion in the mould. This locates the main core centrally there.

The tumbler bracket, Fig. 9, appears to offer two alternatives, but hardly so when looked at closely. That it must be moulded on its side with the face A downwards is without question, because to mould it as in the lower view would either entail leaving loose the ribs and bosses on the sides, or awkward down-jointing. Moulding as in the upper view, the question arises of leaving the upper portion B loosely dowelled on the lower, separated by the curved piece C. But this view will be dismissed, though with a casting of large dimensions will be feasible.

The only good solution is to mould the pattern sideways, and provide a core print, outlined in the lower view, to take out the interior. In that case the piece B can be dowelled on the top face of the print to lift bodily in the cope, instead of lifting the top sand past the perpendicular edges. The inside bosses and the inner curved portion a will go in the corebox. The oil grooves b, b will not be cast, but tooled. The holes in the bosses are cast, using prints on

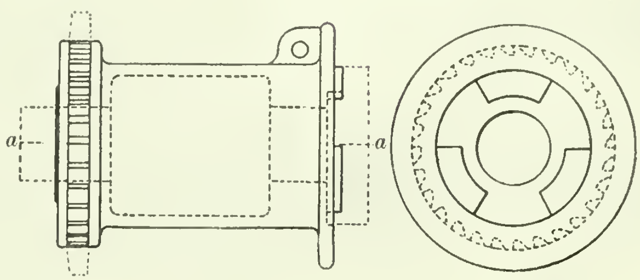


Fig. 8.

the lower faces. Those on the portion B may be provided in the box, as indicated, or they may go on the top faces of the bosses. Or round prints may be inserted to occupy the depth of the box, into which round cores will be inserted to pass continuously through top and bottom bosses. The holes c and d should be left for drilling.

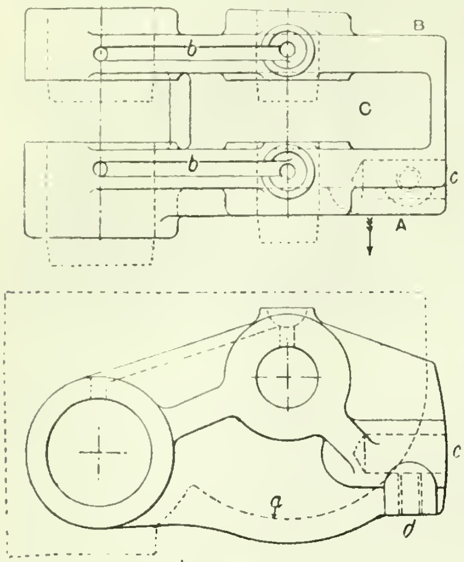


Fig. 9.

Coring is usually the better way of taking out any narrow space, even when it would be practicable to mould directly from the pattern. The core serves as a gauge for the thickness of the spacing, and it leaves a smoother face on the casting. The narrower the space the more reason exists why a core should be employed. Bosses, prints, and other parts can be included in the boxes.

The machine bed in Fig. 10 is typical of a general design that often occurs. There is a top plate, having tee-grooves planed in it, and similar grooves at one or both sides. Metal is thickened round the grooves. Feet are cast, and stiffening ribs. A bracket on one side is included in this instance.

Always the top planed face A is cast lowermost in order to secure the soundest metal there. Whether the mould shall be made by bedding-in or turning over depends on the boxes that are available. For repetition orders a special two-part box would be made, but for occasional castings bedding-in is commonly adopted. Ramming has to be done carefully over the broad area, and the pattern may have to be removed more than once to enable the sand to be consolidated. As the top has to be planed, a little unevenness of surface is of no moment. Some prefer to cast the top solidly and plane or mill the tee-grooves without preliminary coring, which is the safer. Cores are liable to blow, shift. The slots at the side had better be left uncored. If inserted they are put in impressions for which the prints are skewered on, or both slots can be taken out with one core inserted in the impression of a drop print. The waste oil recesses next to the ends had better be cored. They would deliver easily, but might probably have lumpy surfaces if they delivered by bedding-in.

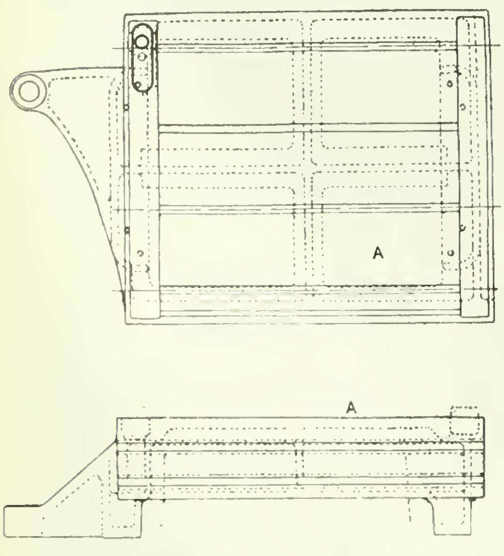


Fig. 10.

The interior of the bed—that is, its underside—delivers itself in the top box, from which a grid or lifters are suspended unless a box is made specially with deep bars to follow the contour of the interior. But the spaces under the feet are cored, which is much easier for the molder than leaving the feet loose. Portions of the ribbings go in corebox. The prints are indicated. The brackets at one end occasion no trouble. It is fixed to the main pattern, and delivers in bottom and top.

MARITIME IRON AND STEEL INDUSTRY

The following article from the Canadian Pacific Railway report on Agricultural and Industrial Progress in Canada, gives an interesting insight on the progress of one of Canada's leading industries:

The iron ore, coal, and fluxing materials which are found in abundance in the Maritime Provinces of Canada have given rise to the iron and steel industry of that area, which has developed to be the greatest of the Maritimes' industrial activities. The growth of the industry has been gradual but steady, and its history over the past hundred years has been one of progress towards giving the area signal renown in this regard. The annual production of this industry is about $35,000,000 per year.

Nova Scotia has numerous deposits of iron ore of limited extent, some of which are of considerable value, but profitable only as they complement other sources of ore supply. In other necessary materials Nova Scotia is likewise well favored, there being plenty of limestone for flux in various parts of the province and several important coalfields. In New Brunswick several deposits of iron ore have been discovered, but the majority are as yet of little economic importance.

The Maritime steel industry had its small origin at the hands of English capitalists in 1825 when ore in Annapolis county was developed. Deposits at Stellarton, Woodstock and other places were subsequently developed by enterprising concerns, the industry on a whole passing through many vicissitudes and tribulations. The real history of the gigantic modern industry which exists to-day dates from 1909, when the Dominion Steel Corporation was formed by an amalgamation of the Dominion Iron and Steel Company and the Dominion Coal Company.

The greatest development in the Nova Scotia steel and iron industry was the formation in 1920 of the British Empire Steel Corporation with an authorized capital of $500,000,000. This was a merger of the Dominion Steel Corporation, the Nova Scotia Steel and Coal Company and the Halifax Shipyards. Its effect was to centralize the control of all the large profitable coal areas of Nova Scotia, the iron ore deposits of Wabana, Newfoundland, and an adequate number of limestone quarries under one management. The corporation has approximately 37 collieries, with a combined yearly output of 6½ million tons, or 93 per cent. of the output of the whole province. The iron deposits of Wabana are practically inexhaustible. The Halifax Shipyards, located at one of Canada's most important ports, is an important user of steel products and heavy forgings, which the steel subsidiaries in the merger are equipped to provide.

Sydney the Steel Centre

Sydney, with $150,000,000 invested in its industry, is the great centre of the Maritime steel industry. There are six blast furnaces with a combined capacity of 1,600 tons of pig iron daily, ten five-ton open hearth steel furnaces and other complete equipment. The output of the plant is in excess yearly of $36,000,000. The plant at Sydney Mines comprises 150 coke ovens, two blast furnaces and other equipment sufficient for the continuous operation of one furnace producing 300 tons of pig-iron a day, five fifty-ton open hearth furnaces and complementary equipment. There is a manufacturing plant at Trenton for turning out forgings, car and locomotive axles, polished shafting and bars, industrial rails, railway plates and structural steel shapes. Adjoining this plant is one for turning out steel, wooden and composite cars, the present capacity of the plant being 25 steel frame box cars per day, which can easily be doubled.

The iron and steel industry of Nova Scotia is now concentrated under the management of one concern, owning its own mines of coal and iron ore, properties sufficiently large to enable production to be carried on for centuries. All necessary raw materials are situated in Nova Scotia or Newfoundland, making a thoroughly self-contained industry, entirely British as to the origin of raw material and manufacture.

Utilization of Canada's Iron Ore Deposits

Americans Are Developing Less Valuable Ores—Electricity Might be the Means of Reducing the Sulphur—Opinions of Different Experts

IN THE last few issues of this publication there have appeared some interesting articles on the subject of Ontario's iron ore deposits. The meeting called at the parliament buildings by the Minister of Mines also added zest to the subject, but so far we have not heard that any great amount of effort has been put forward to get any of them operating. What was said about Ontario's mines was equally as applicable to the entire Dominion of Canada, as there is not, at the present time, a single iron mine being operated anywhere in the country, although in the United States these are mines running much lower in metallic content while equally as high in sulphur, and these are being worked to advantage. "Iron and Steel of Canada," in a recent issue has the following to say on the subject under the heading of:—

A Process to Suit the Ores

"According to a progress report on investigations being carried on at the Seattle station of the United States Bureau of Mines, considerable progress has been made in experimental work in developing to a commercial basis the process of reducing iron to the condition known as sponge iron and melting the sponge in an electric furnace. The Bureau considers that this process is likely to be adopted with success in the Pacific Coast States.

"These investigations are of interest in Canada as they give some reason for hope that our own iron ore deposits may be utilized. At present there is no iron mine being operated in Canada. Under more favorable circumstances some mines will doubtless soon be reopened; but there is a strong probability that with present methods of treatment our iron industry will continue to depend on other countries for its raw material.

"The process now under investigation in Seattle, is one which has been worked on for some years by a Toronto metallurgist, Jas. W. Moffat, and details of it were published in this journal a year ago. It is pleasing to note that Americans are finding that it has great possibilities. The progress made by the investigators at Seattle will be watched with interest, for their work should help solve the problem of finding a method suited to our ores. It would appear likely that the utilization of our iron ores is more likely to be brought about in this way—by finding a process of treatment suitable for the problem rather than by confining attention to beneficiating ores to make them conform to specifications required in blast furnace practice."

In the same paper Mr. J. J. O'Connor writes an interesting article entitled:—

Utilization of Our Ores

"We have been accustomed to the spectacle of a field day of speeches in the House of Commons, every session, devoted to the subject of the development of 'natural resources.' These speeches have taken up a lot of time of the House, they have cost the country a lot of money, yet, not one single practical suggestion has emerged from this fog of talk. Some members rest a large part of their reputation on this annual canter into the realms of popularity, their annual outing on the crest of a popular wave.

"Instead of these 'field days,' if the House would appoint a competent committee of its members to visit, inspect and report upon what is being done in the beneficiation of iron ores in the neighboring State of Minnesota, it would confer incalcuable benefit on the mineral industry of Canada. They would see there, gigantic plants in operation, on ores that are incomparably lower-grade, than the average Canadian iron ore. At Babbitt the iron formation runs from 20 per cent. to 25 per cent. iron content, of a structure requiring fine grinding and sintering, on which enormous sums of money are being expended in order to make it commercially successful. On the Mattawin range in Ontario, there are hundreds of millions of tons of somewhat similar ore, averaging 38 per cent iron content, and of a physical structure that avoids fine grinding and sintering. These two latter processes entail the major portion of the cost of beneficiation of low-grade iron ore. In consequence of the higher iron content, and the better physical structure of the Ontario ore, there can be no comparison made in the costs of beneficiating the two ores. There is a vast difference between ore of 25 per cent. iron content, and that of an ore averaging 38 per cent. natural iron, with the additional advantage of the latter in avoiding fine grinding, and sintering.

"The Mattawin is only one of several iron ranges in Northern Ontario, where similar, or higher-grade iron is to be found, including the high-grade hematite of the Loon Lake range.

"These ranges are all traversed by the Canadian National Railway, and some by the Canadian Pacific Railway, with hauls ranging from 30 to 125 miles to the waterfront, at Port Arthur with grades in favor of the traffic.

"Under an enlightened government policy, these ranges would long ago have been put under tribute to the furnace requirements of Canada, instead of annual importations of iron ore running into millions of dollars, and the labor and merchandising together with other forms of industrial development that would naturally follow, we should be exploiting these ores, and conserving the benefits for our own use and enjoyment.

"Most Canadians are accustomed to think and speak of our iron ore deposits, as being of too low-grade to be commercially available. It is high time they paid some particular attention to the actual qualities, and commercial possibilities of these ores. Nothing could be farther from the truth, than the commonly accepted opinion. All that is required is capital and the necessary enterprise, to not only supply the furnace requirements of Ontario, but to build up a substantial and profitable export trade in iron ore. There are no metallurgical problems to bar the way, these have been solved in the United States ranges.

"Notwithstanding the pre-eminence of Minnesota as an iron ore producing State, and the vast tonnages of high-grade ore within its borders, the Federal government maintains an Experimental Station, at Minneapolis, Minn., that is constantly employed on some branch of experiment in the ore and steel industry.

"This station includes a blast furnace, that was put in blast twelve times during the past year. A similar station is maintained at St. Louis, Mo."

STONE AGERS WORKING IN COPPER MINES

An American commission, searching on Isle Royale for museum material, has unearthed the habitation of an ancient race of people who are supposed to have lived during the stone age. All the surroundings indicate that they were employed in the copper mines which are located in that vicinity. This is the report which the newspapers are broadcasting, but from a museum standpoint it will be rather hard to explain, since museums teach us that the stone age ceased to be when the copper age began. Stone, as a material from which to construct dwellings, did not cease but the stone age, as a period in the world's history, was supposed to be the time when stone was used for such purposes as copper was, later on, used for. The commission has, no doubt, located some stone dwellings which may or may not be exceptionally ancient.

Cleaning of Machine Parts by Sand Blasting

Widening Application of the Process—Installations to Meet a Variety of Needs—Mechanical Handling and Screening of Sand —Constant Change of Air Required—Automatic Equipment

HOW little does the average person realize to what extent the process of sand-blasting is utilized in every phase of life and industry. Your morning bath is taken in a cast-iron tub —sand-blasted to prepare it for enameling; the nickle-plated faucets through which the water is run are also subjected to the same treatment before they are plated in the plating bath. Your breakfast is probably cooked on an enameled range, the parts having been cleaned with a sand-blast to prepare them for the coating of enamel. After you step into your auto to go to business; the motor has been sand-blasted in one plant, the transmission gears in another, and if wire wheels, the metal in the felloes has been cleaned by this process before it is fabricated. On your arrival at the office you are probably carried to the upper floors in an elevator cage which also has been sand-blasted. As you reach for the telephone you do not stop to think that its parts have also been sand-blasted before fabrication. You may have stopped on your way down to get shaved. In that event you sat down in a barber's chair that had also been similarly treated before it had been enameled and nickeled. Possibly your tooth aches, and as you stop into the dentist's office his white furniture has also been sand-blasted for enameling, and it may be that the handles of his tools have been given a matte finish with the blast so they will not slip in his hands. At noon, at the hotel or club, the dishes on which your meal is served have been sand-blasted before receiving the glazed finish. In the afternoon you may attend a funeral. If a metal casket is used, this too has been cleaned by a blast of sand, and if the monument maker is at all progressive, the head-stone has been lettered with the sand-blast. Possibly at the end of the day you slip into an enameled bed, and reach to turn off the electric light, both of which have also been sand-blasted.

Cuts supplied through the courtesy of the Pangborn Corp., Hagerstown, Md.

Varied Application

Sand-blast equipment is not necessarily designed to a single trade, as for instance the same machine that sand blasts dishes is also used for cleaning automobile crank-shafts and other metal pieces. As a rule the type of machine selected is governed more by its size to accommodate the pieces and its method of handling them, and the blast action is accommodated to different commodities by regulation of pressure and grade of abrasive.

Every foundry has conditions and operations peculiar to itself. A sand-blasting installation should be an entirely individual problem. If you are to get results, which is the final test of the cost of a sand-blast system, it is necessary to secure experienced advice from those who have made a special study of sand-blast engineering and practice.

Four General Groups

Basically sand-blast machines will divide into four general groups as follows: Hose machines; cabinets; barrels; and tables. The method of operation may be by either the direct pressure, the suction (syphon) or the gravity systems.

In direct pressure systems the sand is under pressure in a sealed container, sand and air being discharged in combination without expansion through a hose nozzle giving the greatest velocity and highest efficiency possible. The majority of hose machines are of the direct pressure type; indeed, the first application of sand-blasting was the hose machine type and it is still used without exception in sand-blast room installations. It offers a range of application that is possible with no other type. For a line and character of work that is varied and of medium volume it undoubtedly represents the most satisfactory equipment. Where the tonnage is large and the pieces are of a weight and size too great for convenient handling it is indispensable. The use of the hose machine demands some enclosure and experience has shown the wisdom and economy of a well ventilated and well lighted room for the purpose.

While the cleaning cost will always be reduced by mechanical methods of handling the work and the abrasive for reuse, a very convenient room can be provided with small outlay and may be built of rough lumber, with an exhaust fan in the ceiling or wall, carrying the dust-laden air into a settling box or chamber that will retain the heavier particles, the lighter material being carried off into the atmosphere.

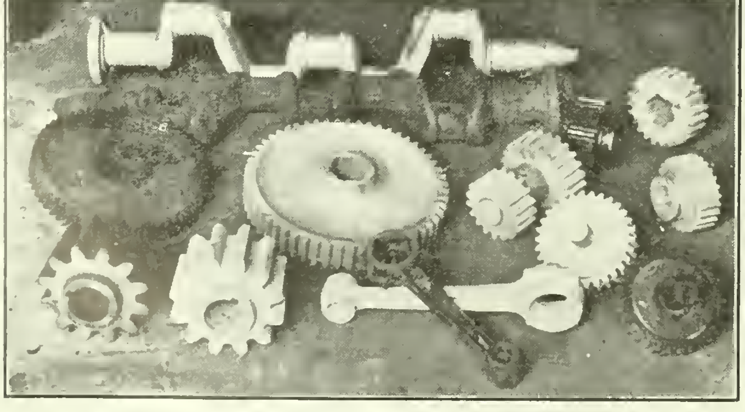
Location of Sand-Blast

The inclusion of mechanical handling and screening of the abrasive makes a steel room most advantageous and economical. The simplest of these provides for the location of the sand-blast outside the room which is left free for the blasting operation, with controls extending inside to within easy reach of the operator. A mechanical separator, driven by a powerful air motor, at one operation removes both fine and coarse material. The clean, sharp abrasive for reuse is delivered by an elevator to a sand storage bin above the sand-blast machine for refilling. In this type of room the spent abrasive is shoveled from the floor to a chute in the side of the room connected to the separator.

Meeting Growing Requirements

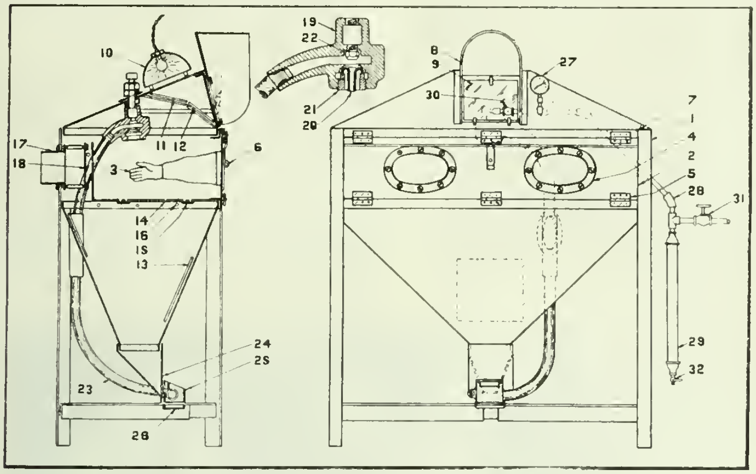
As the daily tonnage rises, the capacity of the sand-blast installation expands (and without added cost for labor) in proportion as appliances are added for the mechanical handling of the abrasive, and the work is properly handled and routed. The problem of handling the abrasive can be met by a grated floor in the room through which the spent abrasive falls to a conveyor below, which carries it to the elevator boot. Built into the elevator system should be an efficient separating system, preferably a combination of mechanically operated screens, with an exhaust to remove the fine material. Thus both the coarse material that will not pass the nozzle and the disintegrated abrasive, core sand and all fine stuff without abrasive qualities are removed.

The clean, sharp abrasive passes to a storage bin and is afterwards refilled in



Gears and forgings before and after sand-blasting.

Approximate flow in pounds per hour of various abrasives through different nozzle openings						
NOZZLE SIZE	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"
Sand	500	900	1200	1700	2200	3000
Metal Abrasives	1250	2250	3250	4250	5500	7500
Maximum Size Sand	No. 1	No. 2	No. 2	No. 3	No. 3	No. 4
Appropriate Size Steel Shot	*No. 5 *No. 12	No. 12 No. 13	No. 12 No. 13	No. 3C No. 11	No. 3C No. 11	No. 1 ———
Angular Grit	*No. 40 *No. 30	No. 20 No. 12	No. 20 No. 12	No. 12 No. 10	No. 12 No. 10	No. 10 No. 6
*APPROXIMATE RATINGS OF DIFFERENT BRANDS						



Construction details of sand-blasting cabinet.

the machine and controlled from within the room. The waste material is carried to a bin with convenient outlets. An auxiliary sand-storage bin loads through a grating opening outside the room, and carries several days' supply of abrasive, which is fed to the system through a gate as renewal is required. This continuous operation may also be accomplished by placing the sand-blast machine itself in a pit beneath the grated floor, but the depth required for properly proportioned hopper to accommodate the entire floor area and the separating system results in a depth of pit and foundation that while showing no economy in cost even by the elimination of the conveyor and elevator, is frequently impracticable due to water conditions and also it makes impossible the advantage of the auxiliary sand-storage for handling the abrasive in volume. Where floor area is, however, at a premium this system may be found advantageous.

Light and Ventilation

Light and ventilation are of course necessary to adequately handle any considerable volume of work. Electric light fixtures with parabolic porcelain enameled reflectors will probably diffuse light equally to all points, and if fitted with protective fronts a perfect protection is afforded the lamps from flying abrasive.

Ventilation which should be ample will of course be governed by the requirements of the work in hand. No hard and fast rule can be suggested for this, but a constant change of air is required and this should be a minimum of say four to six changes per minute for the general run of brass and malleable castings, six to eight changes for cast iron and 10 for steel. A slow-speed exhauster of low horsepower requirements is most satisfactory as well as most economical.

Exhaust System

Some diversity of opinion is expressed as to the most satisfactory system for removing dust-laden air. Theoretically it is desirable to keep the dust in transit below the operator's head, and this theory creates some adherents for the down-draft system whereby the dust-laden air is drawn downward through the grated floor. Failure in practice to keep the gratings clear, however, seriously retards circulation and experience has demonstrated that more positive results are obtained from an up-draft, where there can be no interruption to the draft, and generally better operating conditions secured. As the dust is created where the blasting operation takes place, well above the floor line, and with a general tendency to rise, the up-draft system removes it without change of direction.

In considering claims for conditions provided within sand-blast rooms common sense tells us the dust is there and no improvement is possible over its removal as fast as created. Not only is this rapidity of removal essential from the standpoint of hygiene and sanitation, but equally so to provide for clear vision for efficiency in cleaning. Obviously protection for the operator from the dust-laden air and the flying abrasive other than afforded by the exhaust system must be provided. The most satisfactory device is a dust-proof ventilated helmet. Air is introduced into the helmet from the compressed air line, to which the helmet is connected by a small flexible hose, weighed over pulleys to take up slack in any position and permit ease of movement to the operator.

Cleaning Fragile Pieces

There are classes of work that by reason of shape do not adapt them to barrel cleaning. This includes precision work or pieces that are so light and fragile as to not admit of this method of sand-blasting and are yet too small for individual cleaning to advantage with the hose machine in room installation. For this character of output the automatic revolving table sand-blast, Fig. 10, has found high favor. A grated-top table half exposed and half housed revolves at a slow speed. Within the housed portion a series of nozzles, fed from a direct high-pressure hose blast, are oscillated in adjustment with the varying peripheral speeds of the table so that all points are brought with equal duration within the path of the blast stream. The pieces to be cleaned are placed on the exposed portion of the table as it revolves; they are turned as required and removed when cleaned. A flexible sectional rubber curtain permits passage of

(Continued on page 25)

Sand blasting department of a large forge shop.

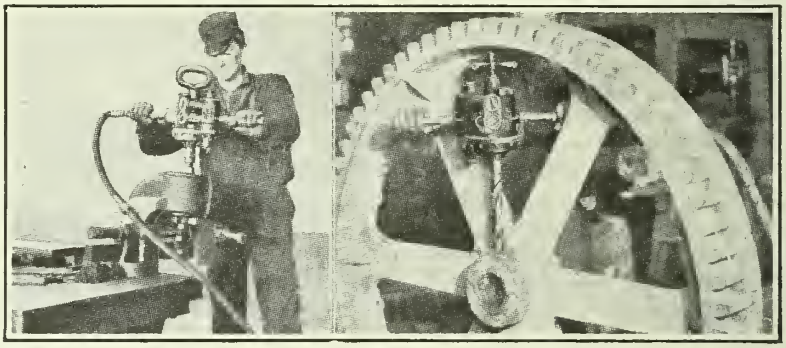
Economy of Operation Dependent on Proper Care

Fine Mechanism of Air Tools Requires Special Attention—Keep Records of All Repairs—Place Responsible Man in Charge—Supply of Extra Parts Should be Stocked

WHEN you compare pneumatic tools with other shop equipment, such as the drill press, lathe and milling machine, you will observe that while the latter are of fine material and workmanship, the air tool is an exceptionally fine piece of mechanism. Being for portable use it must be sufficiently light for convenience in handling, while the service required demands great power and speed. Although other tools are generally used in the tool-room or factory under the most favorable conditions and kept well lubricated, cleaned and free from rust, the air tool is often used in the foundry or shop yard, exposed to sand or dirt and weather conditions and often goes without lubrication until it stops. However, in justice to the user we must say these conditions are fast improving, as he is beginning to realize the importance of caring for this equipment.

Probably the most important factor in any well organized system of maintenance of air operated portable equipment is that of proper facilities for adequate repair and storage when not in service. When a relatively large number of such tools are in constant use it is advisable to have a separate and distinct department especially equipped to look after all repairs. Every pneumatic tool in the shop and every length of hose should be kept track of by record, and a stock book kept to indicate any ordinary or special repair done to the machine, such as fitting new pistons, cylinders, etc. In any plant of considerable size there should be one man who is responsible for the maintenance of the hose and for keeping it in perfect order. In large plants it pays to have one or more inspectors doing nothing else but going round keeping receivers free from water and stopping leaks. He should be given power to put his knife through any faulty hose, and take the number of any man persisting in wasting air. Faulty hose will soon waste money enough to pay the wages of a good many men. Through imperfect supervision a drop of 15 lbs. per square inch has been observed in a plant of 5,000 cubic feet capacity, which was remedied in two days by a change of method of supervision.

Cuts supplied through courtesy of the Independent Pneumatic Tool Co., Chicago.

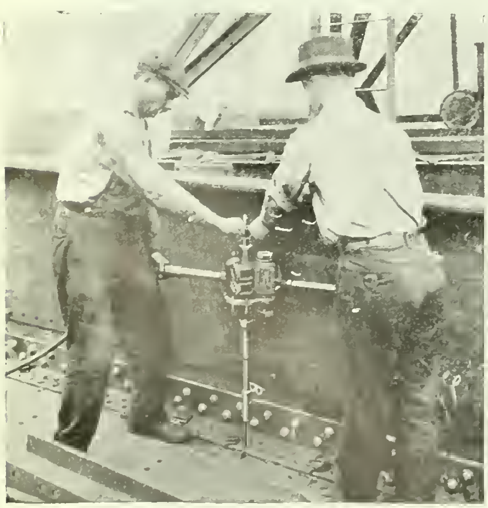


Left—Grinding throttle joints with reversible drill. Right—Piston air drill drilling 1-in. oil hole 3½ in. deep in cast steel gear wheel.

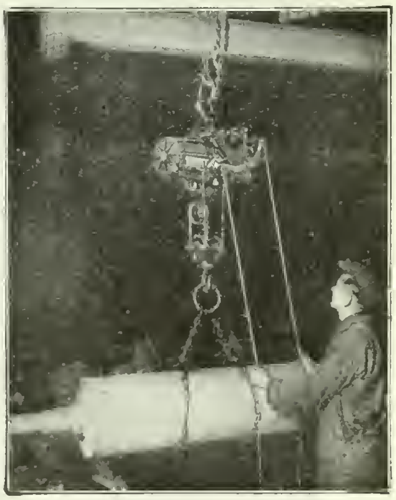
All hose used in connection with compressed air should be of the best quality fitted with a good oil-resisting lining. Poor lining deteriorates rapidly causing pieces to be torn away, stopping the passage of the air and entering and affecting the satisfactory operation of the motor. Very frequently, when a faulty machine is recorded, it will be found that the hose is the cause. Workmen should be furnished with a suitable check spanner, one that can easily be carried in the pocket, for tightening up the hose. It is advisable to supply him with extra washers for service in stopping leaky joints. Faulty connections and leaky cocks can easily be traced if the pressure is left on for a short time after work ceases, as the escaping air can readily be detected when other noises are stopped.

All the tools should be returned to the store at the end of the day, or sooner, if finished with. Tools left outside all night with moisture inside and out soon corrode and lose efficiency. This situation is not improved if the workman takes the next day off and the tool is still left lying about. A little firmness at the start, together with efficient checking of tool numbers, will convince the laziest of workmen that it does not pay to disregard this rule. But it must be clearly understood that the management should back up the tool room foreman strongly in this respect. Any weakness is fatal to the chance of success. Every tool should be looked over for injury or loose parts on its return to store. If anything is reported or noticed wrong, the tool should be passed straight to the fitter's bench, put right, oiled and then placed in its proper rack ready for reissue. Any tool likely to remain in rack for a lengthy period should be oiled and gently worked to allow oil to spread through the working parts before being placed in the rack. All tools should be placed in the paraffin bath at least once a week to clean them of grit. The sockets, etc., should be examined regularly to see that the gauge tools, i.e., drills, reamers, snaps and chisels fit accurately. This is important since in these days of high-speed steel a badly fitting taper socket means broken tangs on expensive drills and reamers; and sleeves worn large in hammers means loss of pressure and hitting power.

Generally speaking, beyond the replacing of worn and broken parts with



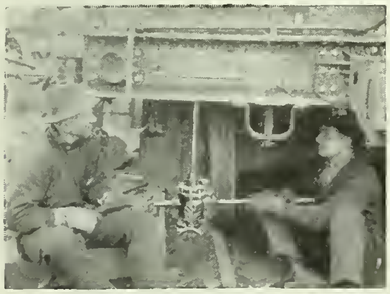
Operating on bridge construction.



Lifting heavy roll with air hoist.

Working in close quarters.

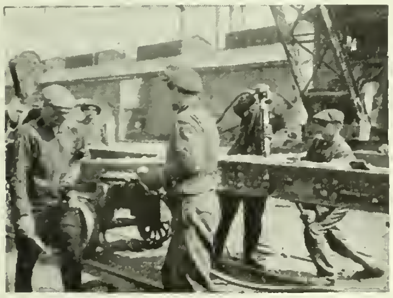
those usually carried in stock in the tool room, very little can be done by the purchaser in the way of repairs to pneumatic tools. For instance, repairs to damaged drill casings, hammer cylinders and handles would be found rather difficult in the ordinary tool room. However, practical economy can be effected by a careful foreman in noting actual wear and tear, and keeping a good supply of spares for the parts that wear most. This may obviate a lot of trouble through tools being out of action, perhaps when most urgently wanted on a rush job. A good investment for the tool room is the provision of a portable testing outfit, consisting of a pressure gauge and air



Reaming end sills on steel car.

meter, capable of recording the air used by any tool in actual work. This is useful when buying new tools to test one make against another, and also to note the efficiency of any tool after so many months or years of use.

If the following rules are observed it cannot help but result in more efficient service and longer life for the air tool: Always blow out the hose and see that tool is well oiled before attaching hose. It will pay to use a lubricant of good quality. For drills use a good grease for crank chamber, and a light mineral oil—that will not gum—for the drill



Driving 3/4 in. and 7/8 in. rivets on steel underframes.

valves and air hammers. Wash machines out occasionally with kerosene, after which they should be thoroughly oiled.

Oil tools at least once every hour when in service. Some plants adopt the system of having a man whose special duty it is to make the rounds of the shop, oiling all tools in service. By oiling around the chisel shank in chipping and calking hammers, the tool will work better and last longer.

Do not overload tools by selecting a machine to do work beyond its rated capacity. Care should be taken to see that air drills are the proper speed for the work. Do not use a high speed machine where slow speed is required. What is gained in speed will be lost in power and it will damage the motor.

When tools are taken out of service they should be returned to the tool room and placed in a solution of gasoline and signal oil, equal parts. This will cut the dirt or other foreign matter—then blow out thoroughly and lubricate before using.

CLEANING OF MACHINE PARTS

(Continued from page 23)

the pieces to and from the housing while retaining the abrasive within the enclosure and protecting the operator from dust and flying particles. An elevator and separator as in the barrel provide for cleaning and feeding the abrasive, making a continuous feed, self-contained unit. The installation of barrel and table together is frequently found advantageous.

Provision in all of these devices is also made for connection to the exhaust system, and it may be noted in passing that exhaust for the cabinet, barrel or table, or all in combination, with grinders as well where desired, can be connected to the exhaust-arrester system of the room installation.

Saving Effected

The keeping of costs on this character of work seems to be fitted more in the breach than in the observance. This may be due to the fact that it may vary in different plants due to the individual conditions, and the fact that there are few plants turning out identically the same pieces. Another reason may be a disposition on the part of the manufacturer to keep these figures to himself, so that it is only in generalities that we can answer this question. For instance we have in mind a gas engine cylinder weighing upwards of eight tons that to remove the cores and clean the casting required two men fifteen hours, or thirty man-hours. With the sand blast cores were removed and the casting cleaned more thoroughly and more efficiently by one man in one hour. In a plant making roller-bearings the raceways have the bore ground on internal grinding machines. Sand-blasting these before grinding increased production on the grinding machines fully fifty per cent., due to removal of oxide scale in the treating furnaces, cleaning of which reduced glazing of the grinding wheels with less dressing required. Not only did production increase fifty per cent., but the working life of the wheels was materially lengthened. In another plant preparing metal for galvanizing where pickling had been previously used, a special sand-blast machine was designed and it is estimated that the first year's use will reduce operating cost by $25,000. Parts to be machined work faster, and as the sand-blast removes the outer scale or skin from the casting, which is most detrimental to the tool, saving in machining cost is effected which varies from fifteen to forty per cent. according to individual conditions.

WONDERFUL BUSINESS DEVELOPMENT

(Continued from page 17)

ready for the cope which will contain the hub and make a cover for the upper flange and the edges of the vanes. This cope is swept up in loam and dried in the oven. The hub, as can be seen, does not go down to the bottom of the runner as it would be in the way of the free escape of the water, so it has to project up above the rest of the casting. This, coupled with the feeding heads necessary for such a heavy casting, will make quite a high cope.

Backing up the Mold

When everything is closed up, the space between the mold and cores, and the concrete wall of the pit is rammed full of sand, after which the first tier of the sectional jacket is put in place and also rammed full of sand. Following this the others are rammed in place. These sectional jackets can be fitted to any size or shape of mold. It will be noted by reference to Fig. 8 that the first tier rests firmly on the concrete wall and cannot be clamped down to do any harm, but the succeeding ones are resting on the sand. For this reason the uprights on which the binding bars rest are stood upon this bottom jacket and this much of the mold is bolted down tight. The remainder of the mold is held by wedges driven under the binding bars, which holds it against possible lifting. The mold is gated on the hub of the runner and poured with one ladle.

This work, as the captions accompanying the illustrations will show, is amongst the largest and heaviest ever done in any country and is a credit to Canadian industry.

Machine Shop

The machine shop which forms part of the plant is equipped with machinery of enormous dimensions but capable of doing the finest work, since paper-making machinery which constitutes a good portion of the output must not be anything but perfect, even though weighing up into tons.

In the next issue of this publication I will endeavor to interest the reader in the production of paper-making machinery which, while differing radically from the water wheel is equally as interesting a line of work.

Industrial Welfare Work in British Foundries

Foundry Work Not Particularly Hazardous, But Much Pain and Suffering May be Avoided—Employers Just as Sympathetic as Employees.

By R. W. PATMORE

This paper, prepared by Mr. R. W. Patmore (London), of the Industrial Welfare Society, and read at the Institution of British Foundrymen, Birmingham Conference, will be read with interest by Canadians since it goes right into the details of what might happen in the foundry, showing conclusively that in Great Britain the foundry is a real institution to be considered.—Editor.

"According to the 'Labour Gazette' and other sources of information it is shown that during the last twelve months an average of three men have been killed each month, and 5 per cent. of the workers engaged in foundry work are injured annually in the foundries of Great Britain. While the percentage of accidents in this particular branch of industry may not be so high as in some other branches (and it must be remembered that the figures and percentages quoted only refer to molten metal and do not include conversion of metal), they are high enough to warrant serious consideration, and the author hopes the subject of his paper will lead to something more than a mere discussion by this Institute, but an actual campaign which will not cease until it has made the foundry the safest occupation in any industry.

"Never was there a time in our industrial history when it was so necessary to eliminate accidents; from now on this country will have to face a severe competition to secure the markets of the world, and every unit in this country will have to utilize all its resources, a its strength, to secure and maintain its position in the industrial world. Not by force of arms will any nation gain supremacy, but by using to the full all the man-productive power (both brain and brawn) of its citizens; Great Britain cannot afford to be unnecessarily handicapped in this race, because of accidents or lack of industrial co-operation.

Employers' Responsibility

"For many years employers have been talking about accident prevention, and in 1912 the Institution set up a committee to formulate certain rules in order to avoid accidents. No doubt many employers have made up their mind as to what shall constitute safety precautions, and some have not, but we must all at least think about it. There is a tendency, due perhaps to some psychological action of the mind, among some engaged in the metal industry, to think, because of the nature of the work, that it is impossible to eliminate accidents. While it is not yet possible to operate a foundry on a 100 per cent. record without accidents for an indefinite period, it should be the aim and object of every managing director of a company operating a foundry to attain this happy condition.

"One of the human instincts (inherent in every person) is to avoid pain and suffering. The spring of human sympathy is just as deep and pure among the employers, therefore surely every member of the Institute of British Foundrymen is seeking the best methods, and the best way, to place his plant among the 100 per cent. record of no accidents.

Analysis of Foundry Work

"At this juncture it should be understood that the author is not a moulder by trade, or connected with the foundry by profession; his only direct contact with a foundry was when he was apprenticed to the engineering branch of the metal industry. He then spent six months of that apprenticeship in the foundry, which was connected with the works. However, in his experience as a production engineer he has had to lay out operation sheets—therefore, in order that the subject can be understood better it is proposed to outline the ordinary operations which take place in a foundry, from the time the pattern is received until the casting leaves the foundry, after which the nature of accidents that sometimes occur in connection with each operation will be dealt with, and suggestions put forward as to how they may be avoided.

Operations in the Foundry

"In the ordinary way these may be set out as follows:—(1) Laying surface board and pattern; (2) placing drag; (3) riddling sand for facing and set nails; (4) shovelling in heavy sand, ramming, venting drag and sticking off; (5) clamping and rolling over; (6) making joint or joints, and riddling sand for facing; (7) placing cope or top; (8) setting gaggers; (9) riddling sand and tucking bars; (10) lifting off and finishing cope or top; (11) drawing pattern from drag finishing and setting cores; (12) closing mould; (13) clamping mould; (14) building runner; (15) pouring metal; (16) taking out casting; (17) cleaning casting; (18) dispatching casting.

Causes of Accident (Major and Minor)

"Placing drag.—The fingers may be trapped or foot squeezed because the men are watching to place the drag square with pattern.

"Riddling sand for facing and set nails.—When riddling sand the moulder is apt to rub his hand over the sand; very often slugs are hidden in the sand which cut the flesh.

"Shovelling in heavy sand, ramming, venting drag, and striking off.—Great care must be taken to have a proper vent. A poor vent not only creates bubbles and blow-holes, but may be the cause of an explosion.

"Clamping and rolling over.—When this operation is being carried out by use of the crane, men should stand clear, even though the box may be properly swung, as the handles, owing to crystallisation, may snap. If roller chains are used hands must be kept clear of the chain.

"Placing cope or top.—Fingers get trapped owing to watching the guiding marks.

"Riddling sand and tucking bars.—Same accidents as operation No. 3.

"Lifting off and finishing cope.—Same as No. 5.

"Drawing pattern from drag, finishing and setting cores.—It is a common practice among moulders to use an old file and drive the tang end into the pattern; if a file is not handy a spike is used. Using a file is very dangerous, and the cause of many injuries to the eye; the file is apt to pull out, or in driving it into the pattern pieces of file fly. Wood screws with proper handles should be supplied to each moulder, and insist that they be used.

"Clamping mould.—In clamping mould it is necessary to see that bolts or clamps are used instead of cotter pins, to examine the bolts, and to see that the threads are not stripped.

"Building Runner.—A bad runner will not only make a bad casting, but if too wet it will blow.

"Pouring metal.—This operation is the cause of the greatest number of major accidents, therefore too much caution and care cannot be exercised. Burns from molten metal can be reduced by the use of leggings with flaps to cover the eyelets of the shoes, also by wearing asbestos boots. Goggles should be worn when pouring. It is very important that the furnacemen be equipped with protective clothing.

"When hand shanks are used the executive in charge of the foundry should make it his special duty to see that the gangways are clear, and pathways as level as possible.

"Care must be taken to prevent foot plates, when used as pathways, from raising up; if they do men are liable to catch their toe and trip. They should be sprinkled with dry gravel when pouring takes place.

"All cranes should be fitted with gongs so that when molten metal is being carried over the heads of the moulders they will be warned.

"All chains should be tested every twelve months, and the maximum load stamped in plain figures.

"Taking out casting.—Same as No. 5.

"Cleaning casting.—The foundry cleaning room is one of the most difficult departments in the elimination of minor accidents. Eye trouble and deep scratches are the most common. It is not within the province of this Paper to deal with dust. It is very important that methods should be applied in every fettling shop to eliminate dust, because of the injurious effect upon the respiratory organs of those employed as fettlers. Poor health is so often the cause of discontent and inefficiency.

"The difficulty of getting workmen to wear goggles is largely overcome when they are made to suit the sight of the operator. A man cannot be expected to wear goggles which, after wearing for about ten or fifteen minutes, make the eyes ache, any more than one would glasses to read with that made the eyes ache. Manufacturers of goggles, especially in the United States, are paying particular attention to this problem, and when speaking to representatives, before making purchases, they have been willing for me to call men in and try out several lenses before the sale took effect.

"It is also recommended that a man be allowed to retain in his possession while employed with the company the pair of goggles that suit him best.

"The steaming of the lenses is also another problem which is receiving careful attention. The author understands this is being overcome, and a metal pencil is now on the market.

Danger of Emery Wheels

"Every possibility of danger cannot be eliminated from grinding wheels when revolving at a high speed. The wheel may be chosen with great care, and be sound in every respect, yet there are many things that can happen to cause a wheel to break—a sudden jam will sometimes cause a wheel to burst. To minimise the results of a bursting wheel is to have the safeguards properly attached to the machine.

Machine Operation

"There is no doubt in the author's mind that the use of machines in foundry moulding is as permanent and evolutionary as the machine is in other spheres of industrial activity, and as far as he can discern the moulding machine cannot be classed as hazardous, but care will have to be taken by the operatives in seeing that the box is firmly and properly secured, so that the jarring of machine will not loosen the bolts. Lock or spring washers being used besides the nut are to be recommended.

Safety and Accident Prevention

"The managing director who would render conscientious safety service must first of all make his plant as reasonably safeguarded and ventilated as his resources permit. He must also get the best illumination possible. It has been the author's privilege to visit some foundries since his return to this country, and he is sure from what he has seen that foundrymen are alive to these factors, but no doubt there are many foundries existing in Great Britain today where it is possible to make changes that will not only be beneficial from the viewpoint of a safety engineer, but from the production engineer as well. However, it may not be possible for the company to change the present conditions prevailing, but it is possible for every managing director to enthuse into his organisation the spirit of safety.

Safety and Personnel

"Successful safety work is not based upon pretence, and it is of vital importance that every effort, and opportunity, be taken of proving to the employees that the company is sincere; just posting a few bulletins on safety does not bring results. Experience in this work convinces those who have been actively engaged in accident prevention that success does attend if eternal vigilance is kept, as well as a determination to concentrate every energy, every resource necessary to minimise the number of accidents, or reduce them to the vanishing point.

"It is very essential that the managing director sets himself the task to ensure that the policy of operating a safe foundry permeates right through his organisation. He must, as it were, test every link of the chain, see that it is sound and imbued with the same spirit and enthusiasm, in order that it be effectual. He must give the lead, especially to the foremen.

Foreman the Keystone of the Shop

"In any industrial establishment the foreman is the keystone of the structure, and too much care cannot be taken in the right selection of foremen. The author's experience has taught him that the men in the department gauge the management by the actions of the foreman. Many boards of directors, managing directors, and general managers have received a shock when they realise that the policy, which had been the intention of the company, had failed to materialise, owing to the wrong interpretation being transmitted to the employees by the foreman. How could it be otherwise, unless the foreman has had the policy of the company explained to him instead of having to guess at it, or perhaps only learns it after he has been on the carpet? If the company has any labour policy, incorporating welfare and safety, the foreman should know of the policy so that he can transmit it intelligently to those under his control.

The Foreman of To-morrow

"Industry is passing through many changes; one of the most important is the status of the foreman.

"The foreman of the future will be the production manager of his department. He will be expected to secure the best results from the labour, machinery and material placed in his keeping; he will have to be a leader of men, display tact, diplomacy and patience. Many of our present-day mechanics, who may be thoroughly capable of doing good work, are slow in adapting themselves to the new conditions and new surroundings. It will be the duty of the foreman to secure for each man a square deal, and instruct the new employee in the little peculiarities of the shop, for it must be noted, and records of accidents prove, that a large percentage of accidents occur among new employees. If the foreman inspires confidence he will be successful.

"Another duty for which the foreman will have to be made responsible is the proper training of the boys. How many employers take the trouble to see whether the boys, or apprentices, to the trade, are taught to avoid doing things in the wrong way? Is it not the common expression to say, 'He will get his usual number of bumps. I got mine, and he will learn better some day,' but that some day may be too late. The foreman should see that each boy learns of the dangers of the work on which he is engaged, especially the occupational dangers which are inherent and peculiar to the trade. The author is of the opinion that it will be beneficial to the employers if instructors were employed to teach the boys in the foundry, instead of leaving the boy to pick up the trade under the present-day system. Every boy should know what he is doing and why he is doing it.

Co-operation of the Worker

"Having secured the co-operation of the managing director and the foreman towards the elimination of accidents, the problem is how to get the workman to co-operate. This is no easy task, and cannot be accomplished over-night, but by persistent education and patience.

Safety and Education

"Besides the usual method of having a safety committee it would be beneficial to explain to the workers that an accident has a threefold effect:—(1) Suffering to the injured person, causing distress of mind, not only to the person injured, but to those of his immediate relatives; (2) loss of time and wages to the injured person; (3) loss of production to the employer—(a) inability of the injured person to perform his usual duties, (b) breaking in a new employee.

Suffering and Discomfort

"The economic wastes resulting from carelessness is appalling, but those who stop for a moment to consider the sorrow and desolation which is brought into the home of the injured person by the lapse of thoughtfulness, feel that they are spurred on to redouble their efforts in the work of accident prevention.

"Methods should be devised to bring

home to the injured person what accidents cost in the loss of wages. It may be imagined that this will be resented, and appear to be adding insult to injury, but when you tell a workman in a tactful, diplomatic way, perhaps by letter, that he has lost so much wages because of a momentary lapse of thoughtfulness, he begins to think twice before taking risks and hazardous chances.

Loss of Production

"When an accident happens the human instinct is naturally aroused. Not only is the injured person unable to perform his duties, but his nearest workmates are interested to ascertain the extent of the injury, and also to render assistance. If the injury is severe, and will prevent the injured person from following his usual occupation for a period, he will have to be replaced, or the organisation rearranged to fill the gap.

Accident Costs are Production Costs

"Assuming that this is correct, the cost of each accident, with its subsequent loss of output, should be charged up to the department. Surely there is no more logical and better way of bringing safety to the attention of the superintendent or foreman than by adding to their operating costs the cost of all accidents that happen in their department.

"If you reduce accidents you inevitably reduce replacement of men, and any industrial engineer knows that the replacement of absent men and temporary disorganisation means decreased production.

"Every industrial problem, and especially the accident problem, when boiled down to the last analysis is the man problem. No matter how we analyse the accident or invent safety devices, have general campaigns on 'Safety First,' we are forced to come back to the individual—the human factor. We must win him, body and soul, to the cause and enrol him under the banner of safety scouts; therefore the author is a firm believer in securing the co-operation of each individual worker, and for this purpose he submits a pledge to which the worker should be asked to subscribe his bond when employed.

The Individual Pledge

"Believing that a careful man is the best safety device, a workman on joining a firm should be asked to pledge himself to (1) keep himself fit, good health being the essential requisite for all things; (2) report to the ambulance room for treatment upon the receipt of the smallest wound or scratch, the neglect of which may result in blood-poisoning and death; (3) use all safety appliances, clothing and guards which have been provided for him and his fellow-workmen, and to see that they are taken care of, kept and used in their proper places; (4) not to wear loose clothing around moving machinery; (5) not to use unsafe tools, but to report the same to his foreman; (6) to wear goggles when pouring, grinding and chipping, or performing any operation where material may fly and cause injury to the eye; (7) to keep the floor space in the immediate vicinity of his work clear of objects over which he or others may fall; (8) to be careful in handling and piling material so that no serious injury may result to passers-by; (9) to be just as careful of a fellow-workman's life as he is of his own, remembering that he, too, may have dependents; (10) to report to the foreman at once all unsafe conditions and practices which may come to his knowledge.

Education and Safety

"In addition to the individual pledge, great success has resulted through the cinema. The author recalls one which his friend Mr. Tenner, one of the safety engineers of the U. S. Steel Corporation, used to exhibit, called 'Steel Town.' While the condition and types of employees are different in America from those of Great Britain, it is a psychological fact that the brain records a more lasting impression on any subject or object when transmitted through the medium of the eye than that of the ear, so it is to be hoped that a time will come when those responsible for manufacturing films, and those conducting cinema theatres, will co-operate with those responsible for industry to exhibit a film having for its purpose the necessity of using caution and thought in daily occupation.

"The day must come—and sooner the better—when educationists will see the necessity of including in the curricula of the schools some simple lectures on accident prevention, in order to train the boys and girls in the elementary principles of safety, so that when they go out into the world they will be better equipped mentally to avoid the common dangers connected with their vocation.

First Aid

"A Paper on safety would not be complete unless reference was made to the rendering of First Aid to the injured. When an accident happens every facility should be at hand to relieve as quickly as possible the pain and distress of mind. It would be of great advantage if every worker would voluntarily take a course of instruction in First Aid to the injured, so that they would be prepared to render efficient help in time of need.

"While it may not be within the province of this Paper to outline what should constitute a well-equipped first-aid station, the author takes the liberty of calling attention to the Home Office regulation, dated 1917, No. 1,067, 'First Aid and Ambulance Station in Foundries':—

" 'In every foundry to which this Order applies, and in which the total number of persons employed is 25 or more, the occupier shall provide, in readily accessible positions, First Aid boxes or cupboards in the proportion of at least one to every 150 persons.

" 'The number of First Aid boxes or cupboards required under this provision shall be calculated on the largest number of persons employed at any one time, and any odd number of persons less than 150 shall be reckoned as 150.

" 'Provided (1) that an ambulance room maintained in conformity with paragraphs 6, 7, and 8 of this Order may be counted as one of the First Aid boxes or cupboards required by this Order; (2) that the requirement of First Aid boxes or cupboards shall not apply to a blast furnace if an ambulance room is provided and maintained as aforesaid.

" 'Each First Aid box or cupboard shall contain at least:—(1) A copy of the First Aid leaflet issued by the Factory Department of the Home Office; (2) three dozen small size sterilised dressings for injured fingers; (3) one dozen medium size sterilised dressings for injured hands or feet; (4) one dozen large size sterilised dressings for other injured parts; (5) one bottle of eye drops; and (6) sterilised cotton wool.

" 'Each First Aid cupboard shall be distinctively marked, and if newly provided after the date of this Order shall be marked plainly with a white cross on a red ground.

" 'Nothing except appliances or requisites for First Aid shall be kept in a First Aid box or cupboard.

" 'Each notice or notices shall be affixed in every workroom, stating the name of the person in charge of the First Aid box or cupboard provided in respect of that room.

Ambulance Room

" 'In every factory to which this Order applies and in which the total number of persons employed is 500 or more, the occupier shall provide and maintain in good order an ambulance room.

" 'The ambulance room shall be a separate room used only for the purpose of treatment and rest. It shall have a floor space of not less than 100 sq. ft. and smooth, hard and impervious walls and floor, and shall be provided with ample means of natural and artificial lighting. It shall contain at least:—(1) A glazed sink with hot and cold water always available; (2) a table with a smooth top; (3) means for sterilising instruments; (4) a supply of suitable dressings, bandages, and splints; (5) a couch; (6) a stretcher.

" 'Where persons of both sexes are employed arrangements shall be made at the ambulance room for their separate treatment.

" 'The ambulance room shall be placed under the charge of a qualified nurse, or other person, trained in First Aid, who shall always be readily available during working hours, and shall keep a record of all cases of accident and sickness treated at the room.

Ambulance Carriage

" 'At every foundry to which this Order applies, and in which the total number of persons employed is 500 or more, the occupier shall, for the purpose of the removal of serious cases of accident

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Apprentice Course on Brass Foundry Practice

Tin, a Soft Metal, Hardens Copper—Two Metals After Being Mixed Will Always Melt at a Lower Temperature Than the Mean Temperature of the Two

By F. H. BELL

IN OUR last lesson we learned that pure copper was the first known metal and that it was used for some time in its pure state. We also learned that it was too soft and had many other peculiarities which unfitted it for general purpose uses. We learned that by adding other metals we could build it up to fill almost any requirement. We learned that different physical qualities were required to withstand the different duties which it is required to perform and that while chemistry and physics are in no way connected we require to know the chemical analysis of an alloy in order to arrive at the proper physical qualities. The physical qualities were, of course, arrived at by experiment and discovery, but by learning the chemical analysis of a satisfactory alloy it is an easy matter to reproduce it.

It will be seen from this that we have several tests which the alloy must undergo to prove its proper strength in the proper direction.

Chemistry is a study by itself and few foundrymen ever go very deep into it. If they do they soon cease to be foundrymen and become chemists. All that the man in the foundry requires is to know what analysis is required and this he arrives at by weight, while the chemist proves for him afterwards if he has arrived at his aim.

The foundryman has other tests which he can do himself, viz., to prove the strength of the alloy, or in other words its ability to withstand the stress to which it will be subjected. Instruments are on the market for testing the different strengths to which alloys are subjected, such as crushing, stretching, bending, twisting, hardness, etc., but it will not be advisable to describe any of these until we have occasion to use them.

Copper as we have seen, was not well suited for general purposes and had to have some other substance added to it to bring it to the right consistency, and the earliest discovery of a material which would answer this purpose was the metal "tin."

Tin

Tin, as far as we are in a position to know, would be the second metal to be discovered, and is, even yet, the most essential alloy for copper. Copper and tin alloys were known in pre-historic times, and while we designate this composition as "bronze" in contradistinction to "brass" which is a copper-zinc alloy, copper-tin mixtures are what were used by the ancients and known as "brass."

Copper and Tin

We now have two metals which we can mix together and make what some might call another metal, but this is not correct, as they are two distinct metals still, and can be separated. Two metals mixed together make what is known as an alloy, although truthfully speaking the copper, or base metal, is still the metal, while the tin, or whatever metal is being added, is the alloy, but these old names are not now adhered to. While it is true that copper and tin remain copper and tin they can be so thoroughly mixed through each other as to apparently lose their identity and form a substance varying in color between the two original metals but in other respects differing radically from either. Copper melts at a temperature of 1996 degress Fahr. while tin only requires 440 degrees, less than a quarter of that required for copper. From this it will be seen that if we are to mix the two together and we put the proper amount of each in a crucible and place it in the fire, as soon as the temperture comes to 440 per cent. the tin will melt and w have to remain in the crucible and become super-heated up to 1996 deg. Fahr. before the copper melts, so that they can be mixed. This it will not do because after becoming melted it will only require a few degrees of higher temperature to bring it to a white heat, after which it will boil, and according to the laws of nature, in connection with all liquids, it will not absorb any more heat after boiling, but will evaporate or blaze. To overcome this the copper is put in the crucible without the tin, and after being melted the tin is introduced and absorbs sufficient heat from the molten copper to dissolve it.

Putting the tin into copper at this high temperature would be the same as putting it in a high temperature crucible without the copper, were it not for the fact that while absorbing the heat it is cooling the copper—in fact chilling the copper with which it comes in immediate contact, but if allowed to lie on top of the melted copper it would soon blaze, and be carried away in vapor. By stirring it through with a rod it changes the entire order of things, making an alloy which does not require such a temperature to keep it fluid. This is the case with all alloys. For instance copper melting at 1996 and tin at 440, the mean temperature would be 1218 degrees, yet an alloy containing equal parts of copper and tin will melt at a temperature much below this.

Another feature which might be termed a phenomenon is that a mixture of equal parts of tin and copper would not be of much use, as these metals can only be mixed to advantage in certain proportions. Copper is a soft metal, and tin is a still softer one, while copper is a comparatively tough metal and tin has very little strength, yet ten pounds of tin added to ninety pounds of copper make an alloy which until recently was considered as the strongest possible non-ferrous alloy. Its tensile strength is approximately 50,000 pounds to the square inch according to temperature at which it is poured, and it is sufficiently hard for the heaviest of journal bearings, and for general purpose machinery "brasses." Although composed nearly all of copper, the small percentage of soft tin which is added is sufficient to increase its tensile strength many times over, and increase its hardness far beyond the mean hardness of the two original metals.

This alloy is known as gunmetal and was formerly used for casting cannon. If tin is added to this alloy it continues to make it harder until one part in every three is tin, or in other words, until one pound of tin to two pounds of copper is reached, when the copper will be thoroughly saturated with tin, after which additional tin will soften the alloy.

Zinc as a Deoxidiser

Now before going further with the question of bronze we will revert to copper for further study, after which we will proceed with the bronze. Copper as we learned in our last lesson has a strong affinity for oxygen, which is to say that when copper is in a melted state the oxygen contained in the atmosphere will actually dissociate itself from the nitrogen and attach itself to the melted copper. This oxidised copper will form on the surface of the molten mass and can not be skimmed off fast enough to prevent it from being in evidence while pouring it. In fact it will form on the stream as it is passing from the lip of the crucible to the gate, and can not be prevented from passing into the mould and injuring the casting. When alloyed with tin this is not so evident, but it is, nevertheless, present to some extent. If, after the copper and tin are thoroughly mixed two per cent. of zinc is added it will remove practically every vestige of the oxygen and leave a clean bronze. Thus 88 copper, 10 tin and 2 zinc is recognized as the standard mixture for general purpose machinery "brasses."

Zinc

So far we only know two metals and we must introduce the third one "zinc" before going any further with it. Zinc

(Continued on page 31)

Crawling Tractor Cranes for Foundry Uses

A Crane Which Will Go Any Place Without the Necessity of a Track—Stands High Test Under Most Adverse Conditions—An Aftermath of a War Necessity

THE CRAWLING tractor crane is a comparatively new or recent innovation in and about the foundry, brought about to a very great extent as a result of the successes achieved by the caterpillar tanks, during the war. War, with its horrors, is odious, but the exigencies of war brought out many improved means of accomplishing results which would otherwise have been delayed for years and, perhaps, would never have been thought of.

The idea of having the wheels of a truck connected by a link belt so that it could cross ditches and gulleys without being stalled was followed up by some of the greatest accomplishments of the conflict. Now that their usefulness in this direction has come to an end, the energetic manufacturer is not slow to take advantage of the lessons learned and is turning out crawling machines for various purposes. A portable crane is one of the most useful pieces of equipment yet brought into use around a foundry, but to be limited to a certain track area has always been its great drawback. Now the feature which was brought to such successful prominence during the war is being utilized to the best of advantage in carrying the crane over all kinds of uncertain roadways to where it is desired to go. Flasks may be stored in high piles in remote corners of the back yard. Castings may be taken from the foundry and delivered to any railway siding or dock. In fact a crane which will travel on any kind of ground, regardless of its condition, can be used for unlimited purposes. Of course if the ground over which it has to travel is so swampy that it will not hold up the weight of the machine, it will be necessary to lay planks or in some way provide for overcoming this trouble, but this will seldom be the case around a foundry.

The two illustrations will show a machine which has just been perfected by the Link Belt Company of Chicago and Toronto.

This machine is ideal for the foundry, as well as for any purpose for which it may be required. It is a thoroughly practical machine which is made of such sturdy construction that it will give reliable service for fifteen to twenty years. It weighs complete without bucket approximately 22 tons, making a ground pressure of 10 lbs. per square inch with standard size of caterpillar treads. It will safely lift 10 tons at 12-foot radius, and 3 tons at 30-foot radius. The hoisting speed is 125 feet per minute with a maximum rope pull of 10,000 lbs. on a single line. Having two independent band-clutch-operated hoisting drums, the standard machine is suitable both for clam-shell and drag-line bucket work. The crane will rotate four complete revolutions per minute, travel ¾ mile per hour, and climb a 20 per cent. grade.

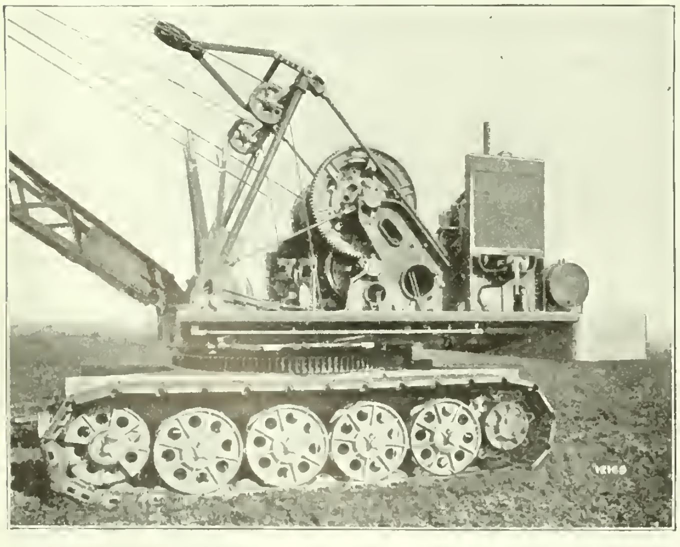
The shoes are 18 in wide, 12 in. pitch, one-piece high carbon chrome steel castings, with machined holes for 1¾ in. diameter high carbon pins. There are eight bronze-bushed crawler rollers, 25 in. in diameter. The over-all width of crawler tread is 99 ft. 7 in., while the center to center of sprockets length-way is 10 ft., giving a bearing area of 30 square feet.

Some of the tests which the machine is called upon to undergo will make anything encountered around a foundry look comparatively easy.

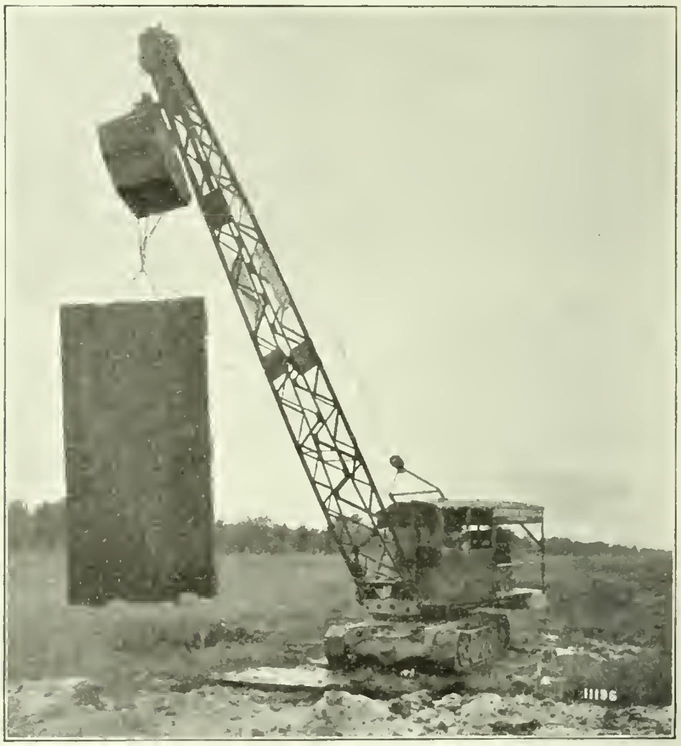
A severe preliminary test has demonstrated that the new Link-Belt Crawler Crane is mechanically perfect. The conditions that this machine has been called upon to meet from the first day of its operation, in connection with the building of a new road through a swamp, consisting of unloading itself from the railroad car, traveling over very uneven country into the swamp, where the footing was so uncertain that it was necessary to lay down wooden platforms, in order to obtain sufficient bearing area to carry the weight, and starting the work of digging in several feet of water, put the machine through about as severe a test as it will ever be called upon to meet.

The following is a quotation from the report of the crane operator:—

"This machine is working in a marsh on floats which weigh about 2½ tons each. The crane lifts them and the clam shell very easily. The material handled is marsh mud and sand. The crane is moving from 300 to 400 yards in 11 hours, with a light ¾ yard bucket. It uses about 25 gallons of gasoline in this time. This yardage does not include a considerable amount of mud overburden, which cannot be used on the road bed, and is dumped back in the ditch. The oil added to the crank case is about 1 quart from the time the crane was started working. Water



Detail view of Crawler crane, showing compactness of machinery, everywhere conveniently located.



Crawler crane, carrying heavy load over uneven, swampy ground.

added in radiator was 1 gallon in three days. From the operating point it takes very little effort to handle the levers and this makes the machine run smoothly and quickly. The hoist drum clutch is the only clutch that has been adjusted since the crane left the shop June 7th."

The above is from a note of June 24th, 1922.

If foundries are to keep pace with other industries they must watch all improved methods, and the crawling crane would seem to be one of them.

COMBINATION CLUTCH AND BRAKE FOR TUMBLING MILLS

The "Safety First" movement has resulted in many improvements in foundry and shop equipment. One of the latest is a combination clutch and brake mechanism for tumbling mills.

This is a simple and really fool-proof device, controlled by a hand lever. Shifting this lever towards the mill engages the clutch and starts the mill. To stop the mill, the lever is moved in reverse direction, passing through neutral to the braking position.

The advantages of such a mechanism are easily seen. A loaded mill can be brought to rest at exactly the right point for unloading and without loss of time. Holding the mill in place by a wood prop or a bolt thrust into the gearing, as is commonly done, is always dangerous. With the combination clutch and brake it is impossible for the barrel to turn after the brake is set, even though the barrel is unequally loaded.

This mechanism was devised by Whiting Corporation, Harvey, Ill., (Chicago suburb) and was thoroughly tested in their own foundry before being placed on the market.

INDUSTRIAL WELFARE WORK

(Continued from page 28)

or sickness, provide on the premises and maintain in good condition a suitably constructed ambulance carriage, unless he has made arrangements for obtaining such a carriage when required from a hospital or other place in telephonic communication with the factory.'

"It is recommended that every member of the Institute will look upon these regulations as the minimum and not the maximum requirements.

"Having outlined some of the causes of accidents in a foundry, and in a brief way suggested methods as to how they may be avoided, the author hopes that as the result of this session the number of accidents in this industrial occupation will not only be reduced, but eliminated altogether. It has been said that 'nothing is impossible, but it takes a little longer time to do it.'

"This no doubt applies to the problem of accident prevention. Let each and every one engaged in industry make as his slogan, 'No accidents to-day.'"

APPRENTICE COURSE

(Continued from page 29)

was not the third metal to be discovered, by any means, as it is one of comparatively recent discovery, but it is a metal which fills a long felt want. It is unlike tin in most of its characteristics. It is hard, even to the extent of being brittle, yet a pound of zinc will not harden more than two pounds of copper, while tin, itself a soft metal, hardens copper, 9 to 1 as in the case of gunmetal. Zinc is a blueish-white metal, and melts at a temperature of 750 deg. Fah. It is a very active and volatile metal and can not be heated much above the melting point without being consumed. In fact it will burn before it will melt if allowed to be heated in the open. When copper and tin are melted and thoroughly stirred, a small piece of zinc dropped into it will create a slight commotion, which will bring o the oxygen which is through the molten mass, and will, itself, be partially consumed, leaving very little zinc in the mixture. This bronze will now be clean, and if poured carefully will not absorb oxygen to any extent.

Copper and Zinc.

While zinc is a deoxidizer for copper and tin, this is not its main usefulness. Copper and zinc are probably more generally used than any other of the non ferrous alloys. Two parts of copper to one of zinc makes the yellowish brass of commerce, while slightly different proportions, make other useful alloys.

We now know three of the chief metals used in the production of brass and bronze, and while these are by no means the only ones they will be sufficient to work from for the present.

In our next lesson we will explain the tests to which the alloys are subjected and will give formulae for different purposes, after which we will introduce some of the other metals.

PURDUE MAN AIDS 57 FOUNDRIES IN STATE OF INDIANA

During July and August R. E. Wendt, of the engineering staff of Purdue University, visited 57 foundries of Indiana and interviewed 100 foundrymen in an effort to help them solve their problems. Mr. Wendt is an expert of extensive practical experience and teaches foundry work in the Purdue University engineering schools.

The plants visited were very appreciative of the engineering extension work offered by Purdue and were delighted that this work has now been extended to the foundries of the state. Many of the foundrymen were in favor of holding a conference or meeting at Purdue University next spring.

A number of the foundrymen expressed their willingness to take Purdue students into their plants during the summer vacations.

This is something which should be encouraged in Canada. Students as well as instructors from the technical schools should visit the foundries, while the men from the foundries, if they can not see their way to attend the schools, should at least visit them and talk with the instructors and students. A few weeks of actual work in the foundry will be of lasting benefit to the student who intends to follow up engineering in any of its branches.

A COURSE IN INDUSTRIAL METALLOGRAPHY

No Previous Knowledge Assumed

Under the auspices of the department of metallurgy at McGill University an extension course in metallography will be given as in previous years by Messrs. Harold J. Roast, F. C. S., F. C. I. C., and Charles F. Pascoe, F. C. I. C.

The course consists of fifteen periods, held on Monday nights at the chemistry and mining building, McGill University, commencing on Monday, November the sixth, at 8.00 p. m.

Application should be made to either of the lecturers, their address being McGill University, Department of Metallurgy.

The fee for the course is $20.00 payable to the Bursar.

Inasmuch as only twelve members can be accommodated at one time, students will be enrolled in order of their applications.

In past years the class has been composed of mechanics, engineers, chemists, and those desiring a winter hobby, or whose business brings them in contact with metals and who desire to have more knowledge of their composition. No previous knowledge is assumed and the course is essentially practical from first to last.

If any students from a previous year desire to continue their work, provision will be made for an advanced course if sufficient members are obtained.

Ferrous and non-ferrous metals are dealt with equally, training being given in preparing them for examination under the microscope, and finally photographing the various structures developed.

DON'T EXAGGERATE

One of the greatest weaknesses of modern business is exaggeration. Too many superlatives are used. People cannot believe all they read and all they are told. This exaggeration leads them to assume a more or less suspicious attitude towards business. Exaggeration is the weakest link in the business chain. It is likely to break when trying industrial conditions arise. It is the link that may spell disaster. The business man who can win the reputation of never exaggerating is bound to make a fortune.

PLATING AND POLISHING DEPARTMENT

A SUBSCRIBER having read the description of heating method for cold nickel solutions, in the Sept. issue of Canadian Foundryman, has written us with reference to a method he employs. He writes:—"Instead of filling my plating tanks at the close of a work day to maintain the required volume of solution, I have practised the following method successfully for several years. Each Monday morning the solutions are all low and each tank requires from two to ten gallons of water to bring to proper working level. I fill a clean barrel which we keep for this purpose only, with water and bring the water to boiling point by means of steam. This water is then added to the various plating solutions and raises the temperature sufficiently to meet our requirements. The actual increase in degrees Fahr. is 24 degrees when ten gallons of boiling water is added to 175 gallons of solution. The desired temperature is obtained on remaining mornings of each week by merely removing a few gallons of solution from each tank and bringing the whole to boiling point as heretofore mentioned. The entire procedure requires but a few minutes and the solution is ready for use immediately."

Answer:—You evidently have arrived at a point where a little experimenting will surprise you. If you will take one gallon of water at 72 deg. Fahr. and mix it with one gallon of water at 188 deg. Fahr. you will find the temperature of the two gallon volume of water is approximately 130 deg. Fahr., or in other words the temperature of the two gallon volume will be 58 deg. higher than the one gallon taken from the tap at 72 deg. and 58 deg. lower than the one gallon which was heated to 188 deg. When injecting steam into a volume of water the maximum temperature reached under ordinary conditions is 210 deg. Ten gallons of water at 194 deg. Fahr. added to 30 gallons of water with a temperature of 66 deg. Fahr. will raise the temperature of the combined 40 gallons to 98 deg., or an increase of 32 deg. 10 gallons of water at 208 deg. Fahr. added to 40 gallons with temperature of 66 deg. Fahr. will raise the temperature of the combined 50 gallons to 96 deg. or an increase of 30 deg. These statements are not taken from a text book, they are the result of actual tests and are intended to show that it would be impossible to increase the temperature of 175 gallons of nickel solution 24 deg. by the introduction of 10 gallons of boiling water. The condition which evidently exists in your case after adding the ten gallons of hot water to the 175 gallons of nickel solution is about as follows: If you use a wire gauze or cheese cloth strainer to break the force of flow when pouring the water into the solution, the water does not immediately reach the lower depth of the tank but actually remains near the upper surface. If you use an ordinary thermometer to determine the temperature of the solution and do not immerse the bulb below the heated strata, the thermometer reading would merely indicate the surface temperature, while at a depth of 15 or 18 inches the temperature might be several degrees lower. For example, by actual test we found that by proceeding as we have stated, the temperature of a nickel solution was 100 deg. Fahr. at the surface while at a depth of 15 inches the temperature was only 75 deg. Fahr. The solution was then thoroughly stirred with a perforated paddle and the temperature at surface was found to be only 84 deg. Fahr. while the 15 inch depth registered 80 deg. Fahr. The temperature of air in the room at time of test was 70 deg. Fahr. In view of the foregoing we do not hesitate in saying you have been taking too much for granted.

The actual conditions were not as favorable as you thought they were. By using the steam pipe or coil as mentioned in the previous issue, and judicious use of a perforated paddle the temperature of a solution may be more uniform in less time and with less labor than by the method you describe. If a worm or hot nickel solution is advantageous, it is reasonable to expect the temperature uniform within practical working limits, and if a warm nickel solution deposits less brittle metal then it is expedient to have the temperature of the lower stratas at least equally as high as the temperature of surface strata, as the rate of deposition is usually appreciably greater at the lower depth. The ideal condition can only be obtained by mechanical agitation and comparatively few platers are blessed with agitating devices, therefore we would strongly recommend the adoption of this simple and efficient method in preference to the method as described in the letter referred to. The changeable weather at this season of the year causes sudden changes in the concentration and physical condition of all plating solutions; these solutions usually regarded as being in the cold class will invariably prove better servants if carefully heated to at least 80 deg. Fahr.

Question.—During the past few months we have had occasion to change the finish on one of our products from nickel plate to black. Our plant supervisor advocated the use of a blueing process in preference to the sulphurette finish on copper plated surface and the blueing method was adopted. The process consists of immersion of the steel articles in a bath of molten salt petre 16 parts and commercial black oxide of manganese 2 parts, the pieces are then rinsed in hot water, dried on a hot plate and lacquered, the lacquer is dried in an oven at 300 degrees Fahr. We have encountered trouble from rust, the surface of the pieces are perfectly clean and free from iron rust when treated, they are lacquered immediately after drying. In course of 3 to 6 days a very pronounced coating of iron rust appears and we believe the rust is beneath the lacquer. Can you advise us of best method of correcting this condition?

Answer.—With reference to protection for the steel article you are treating there is not much advantage in the use of the black oxide of manganese. If you must continue using the formula which you mention, we would advise the purchase of chemically pure black oxide of manganese. The commercial variety contains impurities which will naturally endanger the finish of your product. Furthermore we would suggest the consistent employment of a lime water rinse after the first rinse following blueing, then pass through boiling water free from iron and dry by means of strong blast of compressed air. One firm doing similar work uses an oil dip after blueing—2 lbs. commercial vaseline reduced in 1 gallon of coal oil, heated to 200 degrees Fahr., the parts are then wiped quickly, passed through a drying chamber and lacquered. They claim to experience no difficulty from non-adherent lacquer on the oiled surface and obtain very satisfactory protection from corrosion.

The old time tried simple blueing method free from manganese will give you equally as satisfactory results, except for color, and the desired rich finish may easily be obtained by use of a tinted lacquer. An oxidized copper finish would give best wear and is advised if the cost is not prohibitive. By careful management oxidizing can be performed at very reasonable cost.

Question.—A nickel solution which I am operating has been causing me much worry during past month. The solution is our make from both double and single nickel salts. Just what percentage of each I do not know, but it registers 8 deg. on a hydrometer and has given me good deposits until recently, I use it cold and with a current of 3 to 3½ volts. Cannot say how many amperes as I have no ammeter; work is run ½ to ¾ hours and many of the lower pieces of each batch have black streaks on them. These streaks are of iridescent colors when work is dried off, not a dead black. Usually the streaks are upward from a hole or indentation in the articles being plated and the nickel immediately around the hole is discolored and often flakes off. Sometimes the streak forms on top of the deposits and is easily buffed off, doing no harm. In most cases the streak begins to form before an appreciable deposit forms and such cases are failures. About two weeks ago I added some nickel single salt and believe it has gradually grown worse since. Kindly let me know how to get the solution in working condition again.

Answer.—Before making any additions to your nickel solution inspect the holes in the articles which are subject to streaks and ascertain whether there is dirt of any kind or borax present in or at edge of the hole. Borax used in brazing steel will cause an iridescent black discoloration where the gas is in contact with the steel or nickel surface while escaping from a recess during electro deposition of nickel. This condition is more pronounced in nickel solutions which are operated strongly acid and at low temperature. However, we are of the opinion that your difficulty is due to poor conductivity in the nickel solution. Symptoms such as you describe would develop gradually and would be intensified to some extent by the addition of nickel sulphate if this salt was present in the solution in greater quantities than the nickel-ammonium salt and was operated at low temperature. At this season of the year nickel solutions are liable to sudden changes: solutions containing a considerable amount of nickel sulphate are particularly susceptible to temperature changes, and should be closely watched if chemical tests are not frequently made. To correct the present condition of the nickel solution in question we would add approximately 6½ oz. nickel-ammonium sulphate and 2 oz. sodium chloride per gallon. Make the addition at end of week, stir the solution thoroughly and operate with same current density as has been your practice heretofore. If the solution produces results during early cold weather, similar to that which you describe we would advise raising the temperature at least a few degrees. Examine your anode hooks and see that contacts are good. Anodes which are insulated from tank rod permit excess current to flow to a few and this will cause streaks.

Question.—A small steel crank shaft which we copper plate previous to hardening is subsequently ground to remove the copper from bearing section. Our inspection department have heretofore charged rejections due to fine surface cracks against the heat treating department. Recently they claim to have discovered that the cracks are the result of cyanide copper plating and I am at a loss to know how to act with respect to correcting the trouble. I have found some of these shafts which have the surface cracks before plating, the grinding operation reveals them easily.

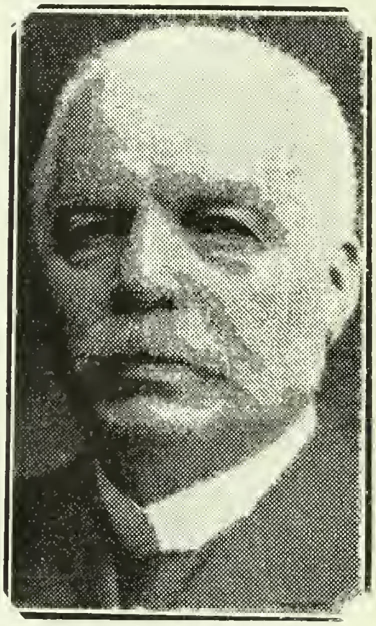
Answer.—This appears to be a clear case of cracks caused by grinding. The cyanide copper does not influence steel surfaces in even a similar manner. It is possible that some member of the inspection staff having learned that cyanide plating baths often embrittle steel springs has applied the information to the crank shaft problem with a degree of certainty not justified by the conditions which actually exist. Harden one or more crank shafts which have not been copper plated, then pickle in 10 per cent. sulphuric acid, this should reveal plainly the fine cracks if they have developed. If careful inspection fails to locate cracks grind the shafts in same manner as is your custom after shafts are copper plated. Note speed of grinding wheel. If inspection results in finding cracks, you may reasonably attribute the effect to grinding. To correct the condition, or rather to prevent it, speed up the grinding wheel. The ratio of increase in speed should be approximately as 500 to 120, that is, if 120 R. P. W. is present speed of wheel increase to 500 R. P. M. The actual condition of wheel has very little bearing on the case if the wheel is properly balanced.

Question.—I have but one nickel tank and our present rush of orders is causing me to experiment with a view of increasing the output of this one tank without deliberately producing inferior plating. I am appealing to you for suggestions as my time is very limited. Our generator is of ample capacity but we lack floor space.

Answer.—The amount of nickel which can be deposited from a given number of gallons of solution depends upon the number of amperes of electric current which may be conducted through the solution without injury to the formation of the nickel deposit. Possibly your present solution could be successfully operated more strongly acidified. You do not give us details of your present working conditions; such information should always be given us when requesting an analysis of a problem, or when seeking advice relative to any difficulty. If you can acidify the nickel solution you thereby decrease the resistance of the solution and naturally with same voltage you could employ higher amperage and shorten the durations of the plating period. Or make the nickel bath more concentrated by addition of nickel sulphate which should be dissolved in a portion of your present solution and neutralized with nickel carbonate before adding to the solution in the plating tank. To get the very best results from this solution you may employ both mechanical agitation and heat. Raising the temperature of the solution will increase the conductivity and render the conditions less liable to affect the production of brittle nickel deposits during the advancing cold season. Agitation will present a constantly refreshed zone immediately surrounding the cathode and reduce the tendency of the solution to produce pitting or cracked deposits at lower portion of cathodes. It should be a very simple undertaking to increase the output of a simple double sulphate nickel bath by at least one hundred per cent. without detriment to the deposits. You will find the addition of from 2 oz. to 3 oz. of sodium chloride to a concentrated nickel solution a great aid in obtaining the desired conductivity and in corroding the anodes readily. Use the 95-97 grade of anodes for reliable plating.

OBITUARY

W. F. Johnston of Toronto passed away at his home last week after a long illness. He was born near Port Hope 72 years ago. During his early life he was associated with the Massey Manufacturing Co., of Newcastle, Ont. Some years ago this company was merged with the Massey-Harris Co. of Toronto.



THE LATE W. F. JOHNSTON.

He is said to be the last survivor of the former company of those associated with it at the time of the initial organization. For many years he was general superintendent of the Massey-Harris plant in Toronto. Mr. Johnston resigned from this position about 20 years ago to become managing director of the Noxon Co. of Ingersoll, Ont. Twelve years ago he retired from active business, since living in Toronto.

A MOLDING RECORD WHICH WOULD BE HARD TO BEAT

The Anthe Foundry, at their Winnipeg branch, have a molder who has been doing some record molding which will compare favorably with anything so far known. This company manufactures cast iron soil pipe and fittings, using molding machines. The molder referred to is working on a double pipe machine, without a helper, excepting that the molders work in pairs for lifting purposes only. In ten days he put up 700 four-inch pipes and out of this number he lost four castings. This is on a basis of about one half of one per cent. which, considering the production, is an achievement which both the company and the man are proud of and which they think will be hard to beat.

White Paint as a Means of Greater Production

Poorly Lighted Workshop Now Out-of-Date—Light Well Reflected Enhances Efficiency—Dark Places Cause Accidents—White Painted Walls Improve Morale in the Shop

FACTORY illumination along scientific lines dates back only a few years yet the progress that has been made in the better lighting of industrial factory buildings shows results that are simply phenomenal, both from an efficiency and economic standpoint. The passing of the poorly-lighted workshop is only a question of time. Plant officials are rapidly recognizing that the old out-of-date method of lighting—where small individual lamps were strung low down over the benches and machines, with shadows predominating in all parts of the shop—is being superseded by artificial illumination carefully worked out by experienced lighting engineers and factory executives.

Following the practice of the early days of artificial illumination when the candle, the open gas mantle and the kerosene lamp were the common medium of lighting interiors, the first attempts—and likewise those of many succeeding years—of electric lighting continued to be along the lines of direct illumination, where the rays from the source of light were directed on the surface or area requiring the most attention. The inefficiency of this method is now a recognized fact and with few exceptions modern installations are of the indirect system, where the distribution is made more effective by means of scientifically designed reflectors.

Advantages of Reflected Light

The advantages accruing from the adoption of reflected lighting systems and the better diffusion of light resulting therefrom, soon emphasized the importance of having the interior walls and ceilings of factories of such a character as would enhance the general illuminating arrangements. The necessity of good lighting in relation to factory management is quite evident from the following beneficial effects:—better working conditions; increased production; greater accuracy in workmanship; less spoilage; reduced lighting bills; neatness and sanitation of plant; less eye strain; reduction of accidents; improved morale among employees, and reduction in labor turnover.

Aside from the many advantages resulting from the installation of modern scientific electric lighting systems, the proper diffusion of such light is of prime importance. Of all contributing agencies, it is a recognized fact that white paint that reflects and diffuses light is one of the most essential factors in the solution of the lighting problem. In selecting a suitable coating for interior finishing where maximum illumination is of primary consideration, it is imperative that a surface be obtained having good light-reflecting qualities; shows no tendency to chip, flake or peel, and one that may be washed frequently without injury to the finish. In other words a surface that will stay white under all varying atmospheric conditions.

Keep Walls Clean and White

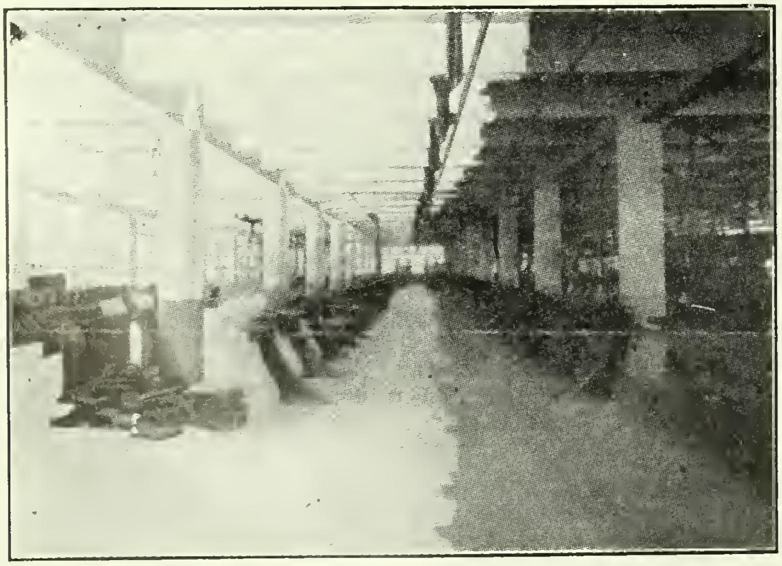
It cannot be denied that clean white walls are an aid to industrial efficiency and an economic necessity. They eliminate the dark corners and minimize the shadows, thus reducing the possibility of accident, and increasing the confidence and good will of the workmen. In coating the walls and ceiling it is good policy to use a paint with a gloss finish white that has a high-reflecting value and insures uniform diffusion of light. Glossy surfaces may be more easily cleaned after becoming soiled, the illuminating value being restored by brushing or washing without injury to the finish. With dark and dingy walls the need of artificial light is often an all-day necessity, but where due consideration has been given to the proper distribution of available light, the utilization of daylight for longer periods, results in a great saving on lighting expenses.

The Influence of First Cost

The initial cost of painting the interior of a factory has often been an influencing factor in determining the character of the coating used. It has been common practice in many large industrial plants to give the walls a coating of whitewash in an effort to improve the general appearance of the shop, but the rapid deterioration of the coating, its susceptibility to absorb dust and dirt, and the inability to clean it properly, has gradually met with disfavor by plant managers and superintendents. With unpainted walls, or those coated with low-grade paint, there is a maximum cost made up of cost of repairs; early repainting; cost of mistakes due to poor light; cost of idleness and accidents; cost of inefficiency; and cost of excess artificial light. It is undoubtedly true that the primary cost of low-grade paint is less than that of the high-class durable quality, but the ultimate cost of the former is often greater when figured over a period of years.

Dark Plants Inefficient

In dark and dingy factories production is invariably below the possible capacity of its equipment and workers. Much of this loss through inefficiency is directly chargeable to poor lighting. It has been stated by illuminating engineers that it takes at least four times as much electrical energy to light a plant with dingy walls as it does the same plant when walls and pillars are painted white. This in itself is an item well worth considering when figuring on initial cost and subsequent maintenance. The higher type of workman is influenced in no small degree by local environment. Shop atmosphere has much to do with human temperament. The clean, well-lighted, sanitary factory has a certain appeal to that class of employee who is a special asset to any organization. Like begets like. If a shop is unclean, dimly lighted and unsanitary, the workers are invariably discontented and inefficient, being unconsciously affected by their unpleasant surroundings, a condition that tends to undermine their health and reduce their ability to carry on their daily labors. The worth-while employee to-day is inclined to stick where working conditions



Partly painted interior of factory. Note the difference in the light.

are ideal, so better lighting, improved appearance, sanitation and cleanliness make for a saving in labor turnover. Statistics prove that the majority of accidents in industrial plants occur during the darker hours of the day and that the winter months have a greater toll than during the summer period. There seems to be only one logical answer to this fact—inefficient lighting. Nothing is more destructive to the nervous system than overstrain to the eyes and this is particularly emphasized when a person's duties are associated with more or less danger.

Light and Accidents

The relation of light to industrial accidents is covered in the following paragraph, reprinted from Modern Industrial Lighting: "Statistics bearing upon industrial accidents, in which operatives or machinery both suffer, closely parallel the figures touching spoilage. Spoilage, or seconds, may by the critical be said to be due to carelessness, bad feeling among operatives, or a false economy upon the part of employers in entrusting machines and material to ignorant or untrained help. But serious personal accidents have a deeper cause, and when the two forms of accidents are found to increase with the days of diminishing daylight and to decrease as the daylight hours lengthen, it is obvious that light is the factor in reducing both.

"A prominent official of a large manufacturing company is authority for the statement that **'insufficient illumination' is frequently held by juries to be 'contributory negligence,'** and in the defence of accident suits the lawyers of this company make it a point to offer testimony by a competent witness to prove the adequacy of the lighting in this company's plants. The subject is not here considered from any humanitarian standpoint; that is something which each manufacturer must face individually. We simply point out that **each serious accident completely demoralizes a shop**; that this demoralization may last for a day or a week, that during this period of distress and excitement the operatives are inefficient and expectant of further trouble; that production drops; while spoilage and 'seconds' due to nervousness, increase; that the absence of employees is greater and that the whole spirit and morale of the plant is broken down. Facing these facts, we begin to see an economic advantage in accident prevention. As to how to accomplish this most cheaply, the authorities on industrial accidents and safeguards for operatives declare that **good illumination would prevent approximately 25 per cent of the avoidable accidents.**

"Two charts, shown herewith, tell graphically the story of loss and suffering which result from inadequate light. In the one we see the ratio between darkness, cloudiness, and sunlight, while the other shows the 'curve' of fatal industrial accidents of three successive years as reported from a large number of industrial plants."

In analyzing these charts it is clear that the greatest number of accidents occur during the months of diminishing light, and it will be recognized that illumination is sadly under-rated as a means of accident prevention. The use and application of any commodity calls for consideration of proven quality, durability and service. These are the fundamental factors which draw the line between initial saving or low first cost, and true economy.

"The Industrial Digest" in an editorial entitled "Efficiency Movement Booms Paint Trade," has the following to say, which shows that there is a decided movement on foot to make the interior of all industrial institutions more fit for human beings to spend their working hours in. The old order of gloom is past, and manufacturers who can not from either a humanitarian or business point see their way to have white walls for their employees to work within, must cease to be considered as up-to-date manufacturers.

Here is what the "Industrial Digest" says:—

"Manufacturers are becoming careful of the eyesight of their workers, and therefore many of them are having the interiors of their factories repainted in light colors.

"A steady demand for paint is likely to result from the movement in industry towards efficiency," says the magazine. "The campaign conducted by the National Eyesight Council has resulted in impressing the need for eye protection upon manufacturers. They have become convinced that not only for humanitarian reasons but for their own profit, it is necessary to surround workers with the best light obtainable. White or light colored walls are becoming the rule in a great majority of factories to-day. Then, too, manufacturers are discovering that it pays to make repairs.

"The building boom, with the large percentage of residence building, has created an enormous demand for paint. And the need for refurbishing the rolling stock of the railroads has created another market which is likely to be active for some time to come.

"The increased interest in civic improvement is another powerful ally of the paint manufacturer. Throughout the country cities and towns are conducting 'clean-up' and improvement campaigns that are certain to result in a greatly increased demand for paint."

While this is just a news item covering the paint industry, the leading feature of it is in reference to whitening up the working quarters of the large army of industrial workers who have heretofore been considered as fortunate in having employment.

Now, what is of most importance to readers of Canadian Foundryman is that of all the different lines of industrial activity there is none to compare with the foundry from the standpoint of "dirty interior," and none which has received less consideration until recently. It is, however, gratifying to know this order of things has changed, and foundrymen are beginning to "whiten up," not with white paint but with "white enamel" which will not hold the dust.

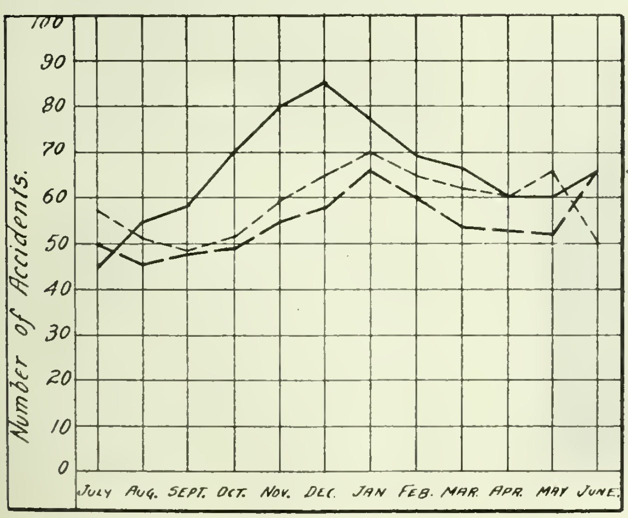
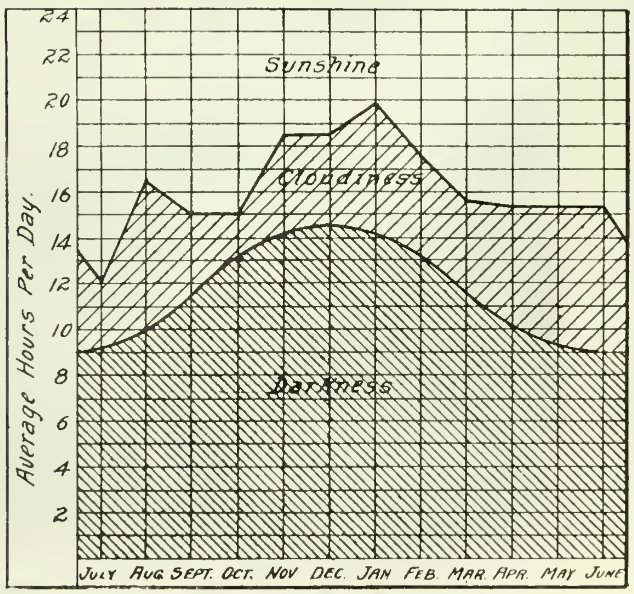


Chart shows majority of accidents occur during the darker period.



Showing periods of light and darkness throughout the year.

Electric Furnace in the Non-Ferrous Foundry

Method Differs Considerably From That Employed in the Steel Industiy, But is Equally as Efficient. Many Canadian Plants Have Adopted Electricity During Last Few Years

THE adoption of electric furnaces for melting non-ferrous metals has been a significant factor in Canadian non-ferrous foundry development during the past year. The list of installations of these furnaces in Canada now embraces practically all sizes from five hundred pounds up to two thousand pounds, while some Canadian foundries are already increasing their original installations by adding additional furnace units.

Greater ease and economy of operation are responsible for this change in furnace equipment. Foundries generally are seeking to better the quality of their castings and reduce the percentage of rejections, and so are turning to electricity as a sure method of producing non-ferrous castings entirely free from porosity and gas occlusions.

Electric melting also cuts the metal loss to less than one per cent. and there is a considerable labor saving over fuel furnaces, because one man can tend a whole battery of electric furnaces; and if but a single furnace is employed, he is available part of the time for other duties in the foundry.

Plenty of Power Available

Power rates in Canada also form a strong inducement, representing a saving which is not available to most brass melters in the United States, where hydro power is not available.

The chief type of electric furnace for non-ferrous work installed in Canada has been the Baily resistance type. Each furnace equipment consists of a transformer, switch and furnace proper, designed to work together upon a very simple and practical principle. The transformer takes current at any high tension voltage up to 22,000 volts and steps it down to the relatively low voltages required by the furnace. Nine low tension voltage taps are brought out from the transformer to a selective oil break switch. The current passes from the switch through two carbon troughs into a circular trough within the furnace. This trough of carborundum is packed with granular carbon material, and when the current passes into this material in the trough it brings it to incandescency, and the heat thus generated is radiated down upon the metal on the hearth of the furnace below. The switch may be closed into any one of nine positions, thus giving an easy and accurate method of control over the furnace voltages and hence exactly controlling the temperature within the furnace chamber.

After the switch has been closed and the metal charged into the furnace no further attention is required from the operator until it is time to pour the metal.

This construction entirely eliminates any complicated parts which might get out of order, increases production and forms as simple and accurate a method of melting non-ferrous metals as has so far been developed. These furnaces are built in a range of sizes from 200 pounds up to 2,000 pounds. A multiple of these units gives an extremely flexible arrangement for handling any tonnage or variety of alloys. In the United States there are more than 100 of these furnaces employed in various non-ferrous foundries.

Among the Canadian installations the following plants are typical of the modern foundries which are adopting electricity as a melting medium for their non-ferrous alloys:—

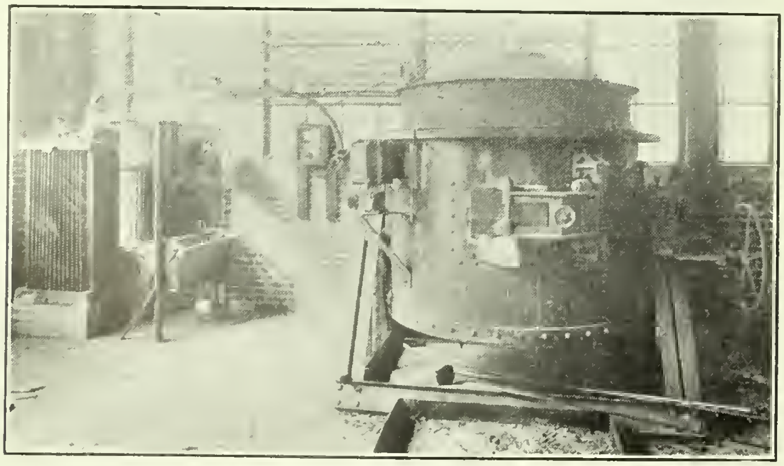
Dominion Steel Products Co., Brantford, uses a 50 K.W. furnace; 500 to 600 pounds hearth capacity; melting rate of 250 to 300 pounds per hour. This furnace is used chiefly for melting red brass and bronze for bushings.

Monarch Metal Company, Ltd., Hamilton, have installed a 75 K.W. furnace with 800 to 1,000 pound hearth capacity and a melting rate of 500 pounds per hour. This furnace is also used for red brass and bronze mixtures running high in lead. This furnace is used chiefly to produce railroad bearings.

Canada Metals Company, Ltd., Toronto, employ a 75 K.W. furnace, producing a wide variety of materials, among which are plumbers' supplies, valves and miscellaneous castings, also yellow and red brass ingot. They are able to melt a wide variety of alloys in the same furnace as with the Baily unit it is possible to change immediately from one alloy to another and it is never necessary to keep molten metal in the furnace as a priming charge.

Union Screen Plate Company, Sherbrooke, Que., use a 75 K.W. furnace for producing heavy castings. Their alloys are chiefly red brass run into screen plate casting molds.

The Empire Brass Mfg. Co., London, Ont., installed a Bailey resistance type electric furnace in their plant in April 1921. After considering the capital outlay and the operating expense for the ensuing year, they felt justified in installing a duplicate of the first one this year, their contention being that there was no waste of metal due to oxidation, which is to say that if they weigh out an exact amount of the different alloys to be used, the resultant metal will be exactly what was planned and will be 100% in weight. In addition to this, there is no change in the chemical analysis due to foreign matter being introduced.



Installation at Dom. Steel Products Co., Brantford, Ont.

HAVE FAITH

"By faith ye can remove mountains." Faith, however, requires action. Just sitting still and hoping doesn't get any man very far. It is faith in himself, in his business, in his country, combined with energetic action, that speeds a man on to success. It's faith that accelerates this speed. It's faith that enables a man to put more intensity into his work. Have faith.

WATCH YOUR CREDIT

Credit has a certain amount of elasticity. It can be stretched to a considerable degree before it breaks. The wise man takes advantage of this elasticity by never straining it except in periods of the greatest adversity. At all other times he keeps it in good condition and well within the breaking point. He uses his credit as he would a life-preserver. He watches it and takes care of it.

The Volta Manufacturing Co., Welland, Ont., are building an electric steel furnace with a capacity of three tons, with transformer and switchboard complete, for the Hopetown Steel Works, Bathgate, Scotland.

Jamieson & Findlay, job platers and polishers, Galt, Ont., announce that in addition to their nickel and copper plating and galvanizing, they are now manufacturing a complete line of sanitary closet seat hinges, and are desirous of getting in touch with jobbers handling this line of goods.

Friends of Mr. Gordon Reid, vice-president of the Hamilton Facing Mill Co., who had the misfortune to be injured in an automobile accident, will be glad to hear that he was not seriously hurt as was at first feared, and is again able to be around and attending to his duties at the office.

John D. Wise, who, after an absence of a year during which time he had charge of the foundry school at the University of Illinois, has returned to the sales department of the Osborne Manufacturing Company, Cleveland, O. Mr. Field is a graduate engineer and his wide experience in the foundry field makes him an able counsellor in all foundry problems.

W. W. Hughes, representing the service department of the Herman Pneumatic Machine Co., manufacturers of pneumatic moldings machinery, Pittsburg, Pa., and Zelienople, Pa., was in Toronto a few days ago in connection with the installation of two large roll-over molding machines, which have been purchased from this company by the Dominion Radiator Co., North Dufferin St.

Darling Brothers, who four years ago added an up-to-date grey-iron foundry to their plant in Montreal, have now added a brass foundry with crucible pit furnaces of different sizes and with a capacity capable of handling pieces up to six hundred pounds. They also have a sand-blasting machine and everything which is required for doing brass and bronze castings from small and intricate pieces, up to the limit of their capacity.

L. S. Tiler, manager of the Cobalt Foundry Company, who resided in Haileybury, had his home entirely wiped out by the disastrous fire which has just swept Northern Ontario, but disregarding this he is working with might and main in an effort to bring comfort to those who were less able to bear their loss. Mr. Tiler was a former resident of Welland, Ont., and was there a few days ago with an appeal for clothing which was generously responded to.

The Hamilton Facing Mill Co., Hamilton, Ont., are doing a lot of rearranging in their mill, preparatory to installing new units of equipment without the necessity of undue building operations. This company, in addition to carrying a full stock of foundry supplies, and manufacturing foundry facing, also does a big business in refining graphite for numerous manufacturers of other lines, such as paint, ink, stone polish, lead pencils, etc. They report business improving from month to month.

Moffats, Limited, stove manufacturers, Dennison Avenue, Weston, Ont., have gone extensively into the manufacture of electric stoves, which has been one of their regular lines for some years back, but which has been increased to such an extent of late as to warrant the expenditure of sixty thousand dollars on additions to their plant, which is being gone on with at the present time. They manufacture a full line of coal and wood stoves, but electricity is fuel which is in demand this season.

The Grinnell Co., of Canada, who last year completed one of the most modern production foundries on the continent for the manufacture of pipe fittings, etc., have found it necessary to put another story on their machine shop in order to cope with the output of the foundry. This plant, which is located at Dundas St., W., Toronto, is so constructed that the work starts from the third story of the foundry and is assisted by gravity as it proceeds towards the machine shop, where it is stored on the lower floor until used. The new story which is the entire size of the machine shop allows all material which is to be machined, to begin from the top and work its way down the different processes which lead up to completion.

The Petrie Brass Foundry, a subsidiary of the Bawden Machinery Company, 163 Sterling Road, Toronto, which has been closed for a short time, has reopened under new management. Mr. R. Micks, a practical foundryman of wide experience, is now in charge and has made numerous radical changes, not the least of which is the removal of the sand tubs, which old time brass foundrymen considered indispensable. Mr. Micks, like most modern founders, can only look upon these as relics of ancient days when mud floors were the rule, and when properly tempered sand could only be assured by keeping it in a box.

BOOK REVIEW

Blast Furnace and the Manufacture of Pig Iron, by Robert Forsythe (deceased) completely revised by Carl A. Meissner and J. A. Mohr, is a 370-page book 6 x 9 and covers the subjects included in its title completely. The illustrations show all the processes in connection with the hot-blast furnace as well as the cold-blast charcoal furnace.

The regular pig-bed floor is shown, while the pig machine is also described and illustrated. As an elementary treatise for the use of the metallurgical student and the furnaceman it is indispensable, but its greatest use to the practical foundryman will be found in the information given on the analysis of different brands of iron, showing the characteristics of each substance which enters into the combination, and its effect on the other elements. Chemistry, particularly as it affects the foundry is explained in a manner easily understood by the non-professional man. The Fahrenheit scale and the British Thermal unit have been given preference in the text, because they are more frequently encountered in engineering writings in English and because data in those units are more readily obtained in America. Bessemer and Tropenas converters, for steel work and many other valuable features in metallurgy and foundry practice make it a book which every chemist, metallurgist and foundryman should have in his library. Published for the United Publishers Corporation, by the U. P. C. Book Company, Incorporated, 243 West 39th Street, New York.

S. S. MOORE, Managing Editor
F. H. BELL, Editor

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Technical Journal Devoted to the Foundry and Metal Industries.

B. G. NEWTON, Manager
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THE MACLEAN PUBLISHING CO., LIMITED, 143-153 UNIVERSITY AVE., TORONTO, CANADA

Labor Shortage

IT WOULD seem queer after so long a period of depression to speak of a labor shortage, but such is actually the case at the present time in some of the industries of the United States. The various strikes are probably the direct cause of this shortage as well as of the upward trend in prices and wages. In the coal mines, the men, after five months' idleness, have been given the 1920 scale of wages. This was undoubtedly the intention of the mine owners in the first place, as it gives them the right of way now to charge outrageous prices and blame it on the men. In the other industries the very reverse is the case. To manufacture pig iron during the last few months was next to impossible as the price of fuel would run it up to a price which no foundryman would pay. In 1894 the very best Connellsville coke was selling at one dollar per ton at the ovens—now it is quoted at $11.50. No furnace can run profitably and pay such a price, and as a consequence the furnaces have been blown out for some months. The men employed at these places have been idle, and of course without income. Now that things are about to move, and the men paid their big wages, the public will have to pay for all the lost time, and no one will be any better off while the public at large will be an awful loser.

Big wages and correspondingly high prices for the product help no one, but prevent competition with the rest of the world, while the lost time makes even the working man's lot worse than it would have been. The difference between $1.00 twenty-eight years ago and $11.50 now has not been brought about by the increased cost of production, but by the increased desire for big profits. While honest business with an honest profit in return for the risk as well as for the investment, is to be encouraged, the method which has been pursued of late certainly makes socialism loom up with possibilities, and gives its advocates a good talking point. Conditions have now arrived at such a pass that nobody knows what to do about making purchases, and as a consequence very few manufacturers are carrying stocks of any kind. Just sufficient raw material is carried in stock to keep them running for a few weeks, and if no orders are on the books no men are employed, but if an order comes it is invariably a rush order, for the reason that no orders are given unless the prospective purchaser has discovered that he can no longer do without the goods. When an order of this kind is let the manufacturer must fill his shop with men and run overtime in order to fill the order in time. Too often the order is not followed by anything of consequence and, after an apparently busy time, the men are told that their services will not be required for a while. This might be for just a short while, as another order may come in which will mean another rush while it lasts. This makes it necessary to have a good stock of men in readiness, which is not always the case. There is, however, an almost normal amount of work to do, if things would just shape themselves so that manufacturers could safely make up stocks of such goods as they know will be in demand.

* * * *

The Railroad Situation

NOW THAT the Canadian National Railways are to be in the hands of responsible executives it is to be hoped that they will be able to at least pay their way and not have an annual deficit to be added to the public debt, as has been the usual custom, but this hope may not be realized for the first year, and perhaps for longer, for the reason that no matter how competent the management may be, there is not the business to be done. We hear all kinds of stories about car shortages, etc., but the railroad yards do not look like it. There is certainly no locomotive shortage. The shop men are clamoring for better conditions, which perhaps they are entitled to, but whether it is possible to grant them or not is a different proposition. At the Pt. St. Charles shops of the Grand Trunk in Montreal the men have not worked full time for a couple of years, and this, without any further reduction in wages, would seem like a sufficient hardship, but how is it to be accomplished?

Even by working three weeks in each month there was not the work to do, and in addition to doing what repair work there was to do, ten brand new freight locomotives were built during the last year, the last one being completed a few days ago. An additional order is now going through for five express locomotives, which will help to keep the shops in operation for a while. None of these engines were particularly needed, but, of course, they will be required sometime. However, it is to be hoped that conditions will be such that the new management will be able to so manage the roads as to have sufficient business to give steady work to their men if they can not satisfy them on the price. The locomotive works at Kingston, Ont., which have been closed for more than a year, are now operating, but principally on repair work which, at least, indicates that things are beginning to move.

* * * *

Foundrymen's Convention in France

READERS of Canadian Foundryman will remember that at the British Convention held at Birmingham a few months ago the advisability of holding an International Congress and Exhibition was discussed. This has now been brought to a conclusion and the meeting and exhibit will take place in Paris during the first two weeks of September, 1923. The American Foundrymen's Association has already been formally invited, and the invitation accepted, and a committee appointed to consider in what manner to participate.

The invitation which Mr. Hoyt, as secretary of the A. F. A., received from E. Rama, President of the Association Technique de Fonderie, Paris, reads as follows:

Referring to the proposed International Congress and Exhibition which has been recently discussed in Birmingham, I beg to inform you, on behalf of the French Association Technique de Fonderie that we have obtained from the Ministere de l'Enseignement Technique the loan of the buildings of the Ecole Nationale d'Arts and Metiers, 151 Boulevard de l'Hopital, Paris, for the first fortnight of September, 1923.

The purpose of this letter is to extend to you a most cordial invitation to join us in the holding there of the proposed International Conference and Exhibition of the British, American, Belgian and French Associations for 1923.

The buildings are quite convenient for holding both separate and joint meetings, and an excellent space is provided for the exhibition. The school foundry will be available for the moulders' and other competitions.

Will you kindly let us know if we can rely on the kind collaboration of your association. We shall be pleased to give you in the near future all details about the organization.

From this it will be seen that a real foundrymen's convention is assured, and there is no doubt but that many Canadians will avail themselves of the opportunity to have the trip across the Atlantic; to visit the gay city of Paris, and to see what is being done in the foundry business in the old world. As the time draws near we will endeavor to keep our readers posted on what is transpiring.

* * * *

Conditions Among the Foundries

FOUNDRIES throughout the country are working in a spasmodic manner as a general rule, but one line which seems to be rushed to capacity is that of heating stoves, furnaces and radiators. These shops appear to be busier than during the best of normal times. Cooking stoves and ranges, while in some demand, are being replaced by gas and electric cookers. Foundries in other lines are busy to some extent but not quite what could be hoped for. Compared with a year ago they are rushed, but there are still quite a number of foundry operatives working or seeking work at other lines, which condition should not exist. As we have pointed out in former articles, the foundry was the last to feel the depression and it is only in order that it should be the last to recover, but its time is about due now, as most of the other industries have been running fairly steady for the best part of the year. The spending habit which developed during the period of the war is still rampant, with the result that everybody is refurnishing his house, with the result that the furniture factories are rushed. This helps those engaged in the manufacture of woodworking machinery. Different other lines, being busy, are helping the foundry and machine shop to be busier than would otherwise be, but on the whole there is room for improvement which, while coming slowly, is surely coming.

OLD BOOKS

To read a book published more than a hundred years ago is a novelty, to say the least. It sends a thrill through the reader when he sees that they were doing the same things then and in the same way as they are done now. Chemistry, with very few exceptions, was the same then as now, while hydraulics and pneumatics were perfectly well known.

Smith's Panorama of the Arts and Sciences, published by Nuttall, Fisher and Co., of Liverpool, in 1815, is a book that any one could read and enjoy, as the language was the simple English, devoid of technicalities and easily understood, but, typical of England, which depends to a great extent on its shipping as a means of existence, much of the material is of this class. Winds of every description are explained, while considerable space is given to the thermometer, the hydrometer, the aneometer, the barometer and the pluviometer, each of which has its place in registering the state of the atmosphere. The engravings are simply marvels of excellence, differing to some extent from the modern ones but not by any means inferior. They resemble, to some extent, the steel engravings of more modern times but were mostly like copper plates, as the art of etching with acids on copper is explained in the book very much the same is still practised, only that it was done by hand without the aid of the photographic apparatus. Hydrostatics and hydraulics are well handled, while electricity and magnetism were most dealt with in connection with the mariner's compass and amusement. The use of electricity for telegraphing had not yet been learned. But what would be most interesting to foundrymen was the knowledge that these oldtimers possessed regarding the metals. Every metal known to mankind at the present time with the exception of aluminum was known to them. They knew all about the specific gravity of each metal, its hardness and the degree of heat required to melt it. But they had never heard of aluminum. They knew about alumine and alum, but the metal aluminum had not been discovered. The book tells of the tin mines of Cornwall producing 3,000 tons of tin annually, but it also says that tin cannot be alloyed with any metal lighter than itself. This may have been true before the discovery of aluminum but not since, as aluminum and tin mix readily and form an alloy harder than either of them.

There are many more interesting things in this old book but they are, perhaps, out of place in a paper of this kind, although every foundryman should know all that he can about metals, and it is interesting to know their history as well as their peculiar characteristics.

Raymond K. Bowden, of Niles, Ohio, has been appointed instructor in metallurgy for 1922-23 at Carnegie Institute of Technology, Pittsburgh. Mr. Bowden is a graduate of Ohio State University, in the class of 1920, with a bachelor's degree of engineering in mining. His practical experience covers two years as superintendent of inspection with the Central Steel Company, at Massillon, Ohio, and one year as assistant to the heat treater at the Crucible Steel Company in Pittsburgh.

The Department of Metallurgy at Carnegie Technical School was recently selected by the United States Naval Academy as its graduate school of metallurgy. Beginning this year, two officers from the Naval Academy have been assigned to take up advanced work in metallurgical subjects at the Pittsburgh institution.

Empire Brass Foundry, 128 Wellington Street, Montreal, Que., are preparing for the erection of a new and up-to-date brass foundry to replace their present one which is inadequate. The new foundry is to be equipped with a considerable amount of new machinery.

KEEP RECORDS

Records are the foundation of progress. They show what must be done to surpass that which has already been accomplished.

Value of Specialized Trade Papers

Address Delivered at Directors' Luncheon of Canadian National Exhibition on Press Day, by Horace T. Hunter, Vice-President, Canadian National Newspapers and Periodicals Association

MR. PRESIDENT, directors and fellow publishers: You have heard from the Daily Newspaper Association, from the Weekly Newspaper Association, and I have been asked to speak for the Canadian National Newspapers and Periodicals Association, which might be termed the residuary legatee of the newspaper publishing business. It is not, however, an uncommon thing for the residuary legatee to get a very large part of an estate.

Over Three Million Subscribers

The extent and influence of publications represented by our Association are indicated by the following approximate statement of circulation:

Farm Papers	1,030,897
Magazines	1,065.307
Religious and Educational Papers	725,000
Business and Technical Newspapers	399,099
Total	3 220,303

On behalf of the Canadian National Newspapers and Periodicals Association, representing over three million subscribers, I wish to congratulate you on the success of this year's Exhibition. We know that it is not like Topsy, "just growed." It has been brought to the high state of perfection it occupies to-day by the shrewd and far-seeing policies of the directors and executive officers, and by their untiring energy in carrying out these policies.

You referred, Mr. President, to the old custom of subscribers to weekly newspapers sending in cord-wood to pay for subscriptions and suggested that some of this wood be sent to relieve fuel shortage in Toronto. Might I suggest that if there is still a shortage some of the "hot air" in the daily newspapers could be used to advantage. (Loud laughter).

It is easy to be optimistic about the Fair to-day; but there are many of us here to-day who can remember the difficulties that had to be overcome and the optimists of twenty-five years ago would probably be looked upon as the pessimists to-day. This situation reminds me of an old settler who was told that they were going to build a railroad right through the village in which he had lived for seventy years. He shook his head, however, and stated: "They'll never run it." The right of way was secured, the tracks were laid and finally a party came to him and told him to come down to the station, that the new train was there and was going to start off in an hour's time. The old settler went down, looked over the equipment and finally, as the train glided gracefully away, remarked: "They'll never stop it." This, Mr. President, must be the feeling of everyone to-day. Nothing will stop your progress.

Similar Aims and Interests

There are many points of similarity between the work of our Association and the Canadian National Exhibition. These form a strong bond of interest and sympathy between us.

Both are *national.* Our subscribers in the various provinces of the Dominion are the men and women you are most anxious to bring to the Exhibition. The fact that they are readers and subscribers of our papers is the proof that they are people of intelligence, students of business, interested in new methods and in learning of new goods. They are the people who will travel a hundred or a thousand miles when the opportunity offers to see an exhibition such as you have developed, and I congratulate you that these people are coming in increasing numbers each year.

The international aspect is also a common bond. You have an increasing number of visitors from foreign countries, thus creating a feeling of good-will with these countries, and helping our manufacturers to establish connections abroad. The same reason that brings business men from United States, Great Britain, West Indies, etc., also causes them to subscribe for our publications. These foreign subscriptions have become such a big factor with some of our publications that they are now issuing Export editions.

Educational Aspect Most Important

Then we are on common ground in educational work. I believe this Exhibition was started primarily for educational purposes and its great success is due to the fact that you have never allowed the amusement side to dominate. I believe the educational features should be given wider publicity. The individual exhibitors do a good deal in this connection but there is much to be done collectively. A few people would come to see a few exhibits of motor cars, but thousands will come when they know there will be seventy exhibitors representing probably seventy per cent. of the manufacturers who are seeking Canadian business. In our Association there is a publication for practically every line of business. These publications have told, year by year, the outstanding events of the Exhibition that would be of interest to their readers, and I think we can claim that this has been a factor in increasing interest and attendance of a very desirable class of people.

Influence of Business Press

I would like to quote briefly from an address delivered within the past year by His Honor, the Lieutenant-Governor of Ontario, who officially opened the Exhibition this year. Addressing the Canadian National Newspapers and Periodicals Association, His Honor said:

"I believe that the influence of the business press will be one of the most important factors in re-establishing business conditions in Canada on a safe and sane basis. I make a distinction between the business newspapers and the daily press because I believe that your papers—the business newspapers of Canada—exert a greater influence than the daily press because of the greater confidence your readers have in them. People read the daily newspapers to keep abreast of the general news of the day. They are interested in what is happening around them and they read to satisfy their desire for excitement or interest or entertainment. What they read in the daily newspapers to-day is forgotten to-morrow.

"But this is not the case with the business newspaper. Business men need the service of these papers in the conduct of their every-day business life. I have noted that they usually have a business paper or two in their pocket when they go home Saturday night I do not say that they read them on Sunday, that I do not know, but I do know that they study them carefully and a great number of your readers will come

(Continued on page 42)

HAMILTON

FOUNDRY FACINGS — MADE IN CANADA — **FOUNDRY SUPPLIES**

Branches at Toronto, Winnipeg and Vancouver

Canadian foundries are now enabled to secure Hamilton Foundry Facings and Supplies at Branches which we have established in Toronto, Winnipeg and Vancouver. You can order from any of these branches (see addresses below) with the same assurance of service as if you ordered from our headquarters in Hamilton. But of course, if you are located nearer any of our branches you will secure quicker service. At our branch plants we carry an adequate stock of the following famous Hamilton lines:—

XX Ceylon Plumbago	**No. 206 Ceylon Plumbago**
Climax Silver Lead	**Imperial Plumbago**
Climax Partine	**Climax Core Wash**
Gambite	**Climax Core Compound**

In fact at our branches we have a complete stock of foundry facings and supplies to meet all your requirements. **Try our branch service in your next order if convenient.**

The Hamilton Facing Mill Company
Limited

Head Office and Mills :
HAMILTON, ONTARIO, CANADA

BRANCHES :

TORONTO—The Hamilton Facing Mill Co., Ltd., 48 Abel St.
WINNIPEG—The A. Adams Supply Co., Ltd., Galt Bldg.
VANCOUVER — The Chowne Chemical Co., Ltd., 918 Pender St. W.

SPECIALIZED NEWSPAPERS AND C. N. E.

(Continued from page 40)

"This is the situation, I can show it to you in this clipping." For that reason, gentlemen, I say that yours is the greater obligation, because you are leaders, because you are helping to build up the business fabric of the country.

We appreciate the honor the C. N. E. has conferred on the Press in singling out a day in their honor. In a larger sense, however, every day is "Press Day" for some of the publishers in our association. Our publications are of such a varied nature and cover such diversified fields that in nearly every case there are one or more publications devoted to the industry that gives the day its name.

Now, I believe the directors are interested not merely in bringing the numbers but bringing the men and women with a stake in the country—the responsible people, the people of large buying power. To put it in newspaper language, you are interested in class in circulation rather than in the mass circulation.

In every one of the lines mentioned above, our publications reach a large percentage of the best men and women engaged in the business, and reach them with publications that they have come to regard as their business associates.

I can assure you the publications in our association will be very glad to cooperate with you, not only in organizing exhibitors and inducing them to guarantee the cost of the building, but in making the buildings a success after they are erected by bringing to the Exhibition the class of people these exhibitors want to reach. For, after all, the real success of an Exhibition does not consist in large buildings or elaborate exhibits but in the class of people who attend.

ELECTRIC STEEL ANVILS

A blacksmith's anvil is a simple looking contrivance as it sits on the end of a post in front of the forge, but when the blacksmith is standing in front of it exhausting the limit of his muscular ability in beating out a plowshare or a horse shoe does he ever give a passing thought to the amount of labor which must have been required to beat the anvil itself into shape from the crude wrought iron and steel. It is even more of a trick to do it than it would appear to be, even after the most careful study, as the face must be of a special brand of steel which will take a temper, while the rest of it only requires to be a good brand of iron. Of course in modern times the steam hammer and the trip hammer play a prominent part in forging anvils, but before they came into vogue the hand-operated sledge was the only means of putting them in shape.

But what is the use of going to all of this trouble when they can just as well be cast?

Casting Them Now

Iron is iron, no matter whether cast or forged, and steel is iron, plus a few chemical additions, and this holds good whether cast or forged. Now if we can get the proper chemical analysis in a casting there is no reason why it is in any way inferior to a forged one.

At the electric steel foundry of Thomas Davidson & Co., Montreal, these anvils are being cast by the hundred and giving the best of results. The molds are made in the ordinary way from split patterns and after being closed are clamped between two iron plates and rolled up on edge so as to have the face down when poured. The sand is a coarse loam, rich in silica, and is tempered with rich molasses-water. The molds are painted with a wash made of silica flour and baked. The metal is melted in the electric furnace and when ready to pour analyses approximately .9 per cent. carbon, .8 per cent. nickel and 2.4 chromium. When the casting is taken from the mold it is just like ordinary mild steel and is easily machined. It is put in the planer and planed true on the top and down the sides and then tempered.

Tempering a piece of this weight is not an easy matter to perform, but it has been successfully accomplished. It must be remembered that if a red hot anvil is dropped into a barrel of water the water will not lie against it but will be forced back from it until the anvil cools off sufficient to allow the water to close around it. By this time it is too late to do any good and it will come out as soft as ever, because the inside will be red long after the outside becomes black and this hot interior will continue to anneal the outside until the entire chunk is cold. This, however, is not the method adopted, and if it could be accomplished it would not be satisfactory in a cast anvil as it would be hard all over instead of just on the face and would not have sufficient strength. In the case of a forged wrought iron anvil with a steel face, the face only could be hardened for the reason that wrought iron does not became hardened by quenching, but with the cast steel one the entire casting is of the same composition and nothing but one face is to be subjected to the cooling process.

Tempering

To do this a small vat of soapy water is provided. About an inch or a little less below the surface a woven wire, with about a quarter inch mesh, is suspended from one side to the other and on this the anvil is placed with the face downward. This, of course, cools the face only, because only the face is submerged. One difficulty which had to be overcome was that the end opposite to the horn, being less bulky than the rest, would cool before the balance and would crack across the hardy hole. To overcome this a heavy piece of iron fitting tight to this portion of the anvil is provided. This is bolted tight to the anvil and heated with it. As the anvil is cooling in the soapy water this chunk prevents the light end of the anvil from cooling any more rapidly than the heavy part.

These anvils have been giving the best of satisfaction and there is no reason why they should not, as with modern methods, and knowledge of steel founding, it is quite possible to melt and cast metal with exactly the same chemical analysis as forged iron or steel, even to the most ordinary common iron and steel or the more modern nickel chrome steel.

U-S MOLDING MACHINE CO. CHANGES HANDS

The Johnston & Jennings Company of Cleveland, Ohio, has taken over the manufacture and sale of the entire line of The U-S Molding Machine Co. They propose to carry on the line, including the plain squeeze, the jolt squeeze, the jolt squeeze pattern draw, the jolt squeeze roll over pattern draw, the jolt roll over pattern draw, the plain jolts and the jolt stripper machines.

They will also carry on the line of vibrators, knee valves, etc.

New machines, repair parts, vibrators, etc., will be carried in stock for prompt shipment.

In the near future a new catalogue will be ready for distribution with several additions to the above line.

The Johnston & Jennings Co. is an old and well established concern with its own foundry, machine, forge, and engineering departments, and will devote its best efforts to maintaining the quality of this line and improving it wherever possible.

PAN-PACIFIC CONVENTION AT HONOLULU

A remarkable gathering is scheduled to be held in the center of the Pacific Ocean this fall.

From October 25th to November 8th in Honolulu the "key men," in matters of commerce and finance, from the lands bordering the greatest of waters are to meet each other daily to formulate plans for future interracial co-operation in bringing about the development of those interests common to all the peoples of the Pacific area.

These men representing government departments or commercial bodies are being carefully selected from each country. They will be guests of the Pan-Pacific Union.

Alexander Hume Ford, director of the Pan-Pacific Union, has made a tour of the United States and Canada in the interests of the conference and is now meeting in their home cities those who will attend from the Orient. Percy Hunter, one of the Australian founders of the Union, has made a trip from London to Hawaii and back to Australia to interest that country in sending a representative delegation.

CLASSIFIED ADVERTISEMENTS

TWO CENTS A WORD, including the "Canadian Foundryman" box numbers; minimum charge is $1.00 per insertion, for 50 words or less, set in 6 point type. Each figure counts as a word. Display ads., or ads. set in border, are at card rates.

POSITION WANTED

BRASS FINISHER, GOOD ALL ROUND MAN, lathe and bench hand, plain pattern making, good knowledge of polishing and plating. At liberty July. Go anywhere. Box 704 Canadian Foundryman.

PRACTICAL FOUNDRYMAN, 25 YEARS ON light, medium, and heavy work, green and dry sand. Bench, floor and machine molding. Melt by analysis and thoroughly competent on Cupola practice. Good reference. Box 707, Canadian Foundryman. (C.3F.)

CLOSING TIME

Advertisements for this section must be in our hands on the 9th of each month.

In order that the announcements of your wants, etc., shall not be delayed, please try to have them in our office as early as possible.

CANADIAN FOUNDRYMAN

MODERN EQUIPPED FOUNDRY FOR RENT

A WELL-KNOWN MANUFACTURING plant will rent their UP-TO-DATE foundry to responsible party. **They will also take large proportion of output.**

Floor space of main foundry is 140 feet by 60 feet, and all modern equipment is included. Following are some of the UP-TO-DATE facilities:

LARGE CUPOLA, ELECTRIC OVERHEAD CRANE, CONTINUOUS ELEVATED TRACK, METAL POURING CRANE, SAND BLAST, TUMBLING BARRELS, PATTERN SHOP, COMPESSED AIR LINES, CORE OVENS, RAILWAY SIDING.

This is the chance of a lifetime. None but responsible parties need apply. Rent reasonable and prospects particularly bright. For further particulars write, Box No. 709.

CANADIAN FOUNDRYMAN

PATENT NOTICE.

TO ALL WHOM IT MAY CONCERN:

Be it known that CHARLES PRACHE, of Paris, France, is willing to license any Canadian manufacturers under his Canadian Patent No. 203,025, for EVAPORATOR.

Further information may be had by applying direct to me, or to Messrs. Marion & Marion., 364, University Street, Montreal.

FOR SALE

BARGAIN IN USED ELECTRIC FURNACE—A one-ton Volta Electric Furnace for melting steel, grey iron or Ferro alloy furnace, 220 volts, 25 cycle, 3 phase; complete equipment. For further particulars write Hiram Walker & Sons, Metal Products, Limited, Walkerville, Ont., P.O Box 156. (c.t.f.f.)

WANTED

WANTED—A TABOR MOLDING MACHINE squeezer No. 10—34" between upright, to be in A1 condition. State price. Apply W. J. Dalgleish, 221 Dundas St., Galt, Ont.

POSITION WANTED BY FOUNDRY Foreman, 25 years practical experience on Stove, Furnace, Boiler Sections, Match Plates, and Moulding Machines. Capable of figuring costs. McLain graduate, presently employed but desires change. Address Box 706 Canadian Foundryman.

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Directory of Foundry Supply Houses

The Buyers' Directory of Canadian Foundryman was originally intended to contain information regarding lines in the production of which the advertisers actually specialized. We now carry the advertising of leading supply houses, some of whom represent scores of manufacturers, in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the supply houses so we recommend that for all general requirements our subscribers communicate with the supply houses listed below:

The Hamilton Facing Mill Co., Limited, Hamilton, Ont.

Frederic B. Stevens, Windsor, Ont.

The E. J. Woodison Company, Limited, Toronto, Ontario; Montreal, Que.

ANODES, BRASS, COPPER, NICKEL AND ZINC
W. W. Wells, Toronto, Ont.

ARGON
Dominion Oxygen Co., Toronto, Ont.

BRASS FURNACES
Hawley Down Shaft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.

CHEMISTS
Charles C. Kawin, Chicago, Ill.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Indiana

CORE MACHINES
American Foundry Equipment Co., New York City.

CORE OVENS
Damp Bros., Mfg. Co., Toronto, Ontario.
Monarch Engineering Mfg. Co., Baltimore, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.

CORE PLATES
Damp Bros., Mfg. Co., Toronto, Ont.

CORE SAND
Benson & Patterson, Stamford, Ont.
George F. Pettinos, Philadelphia, Pa.

CRANES
Northern Crane Works, Ltd., Walkerville, Ont.

CRUCIBLES
Joseph Dixon Crucible Co., Jersey City, N. Y.
J. H. Gautier & Co. Jersey City, N. Y.

CUPOLAS
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co. Cleveland, Ohio
Monarch Engineering & Mfg. Co., Baltimore, Md.

CUPOLA LININGS
Whitehead Bros., Buffalo N. Y.

DUST ARRESTERS
W. W. Sly Mfg. Co. Cleveland, Ohio.

EDUCATIONALISTS
McLain's System Inc., Milwaukee, Wis.

ELECTRIC RIDDLES
Great Western Mfg. Co., Leavenworth, Kansas.
Preston Woodworking Co., Preston, Ont.

FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FIRE BRICK
Bailey & Bell Firebrick Co., Toronto, Ont.

FLASKS, SNAP
American Foundry Equipment Co., New York City.

FLASKS, STEEL
American Foundry Equipment Co., New York City.

FLUXES. IRON, BRASS, ALUMINUM, COPPER
Basic Mineral Co., Pittsburgh, Pa.

GRIT AND SHOT, SAND-BLAST
Pangborn Corp. Hagerstown, Md.

LADLES
Damp Bros., Mfg. Co., Toronto, Ont.

LADLE SHANKS
Damp Bros., Mfg. Co., Toronto, Ont.

MAGNETS
Dings Magnetic Separator Co., Milwaukee, Wis.

FLUOR SPAR
Basic Mineral Co., Pittsburgh, Pa.

FOUNDRY ENGINEERS
Austen Company, Cleveland, Ohio.
Charles C. Kawin, Chicago, Ill.
H. M. Lane Co., Detroit, Mich.
McLain's System Inc., Milwaukee, Wis.

FURNACES, OIL
Hawley Down Draft Furnace, Easton, Pa.
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES, GAS
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES COKE
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES ELECTRIC
Pittsburgh Electric Furnace Corp., Pittsburgh, Pa.
Electric Furnace Co., Salem, Ohio.

GRINDERS, PORTABLE
A. W. Sainsbury, Ltd.
Cleveland Pneumatic Tool Co., Toronto, Ont.

GRINDERS, SWINGING
A. W. Sainsbury Ltd., Sheffield, Eng.

GRIT AND SHOT, SANDBLAST,
Globe Iron Crush and Shot Co., Mansfield, Ohio.

HEATERS
E. J. Woodison & Co., Toronto.

HOSE COUPLINGS
Cleveland Pneumatic Tool Co., Toronto, Ont.

INDUSTRIAL ENGINEERS
H. M. Lane Co., Detroit, Mich

IRON CEMENT
Smooth-On Mfg. Co., Jersey City, N.J.

KAOLIN
Whitehead Bros., Buffalo N. Y.

MAGNETIC SEPARATORS
Dings Magnetic Separator Co., Milwaukee, Wis.

METALLURGISTS
McLain's System Inc., Milwaukee, Wis.
Charles C. Kawin, Chicago, Ill.

METAL PATTERNS
Bryant Pattern Works, Windsor, Ont.
Hamilton Pattern Wks., Toronto, Ont

MOLDING MACHINES
American Foundry Equipment Co., New York City.
Herman Pneumatic Tool Co., Pittsburgh, Pa.
Tabor Mfg. Co., Philadelphia, Pa.

MOLDING SANDS
Whitehead Bros., Buffalo N. Y.
Benson & Patterson, Stamford, Ont.
Geo. F. Pettinos, Philadelphia, Pa.
Venango Sand Co., Franklyn, Pa.

OXYGEN
Dominion Oxygen Co., Toronto, Ont

PATTERN MAKERS
Bryant Pattern Works, Windsor, Ont
Hamilton Pattern Wks, Toronto, Ont

PIG IRON
A. C. Leslie & Co., Ltd., Montreal.
Steel Co., of Canada, Hamilton, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co, Toronto, Ont.

PULLEYS
Dings Magnetic Separator Co., Milwaukee, Wis

RIDDLES
Great Western Mfg. Co., Leavenworth, Kansas.
The Preston Woodworking Machine Co., Preston, Ont.

SAND
Benson & Patterson, Stamford, Ont.
George F. Pettinos, Philadelphia, Pa.
Venango Sand Co., Franklyn, Pa.
Whitehead Bros., Buffalo N. Y.

SAND CUTTING MACHINES
American Foundry Equipment Co., New York City.
H. L. Wadsworth, Cleveland, Ohio.

SAND MIXERS
Phillips & McLaren Co., Pittsburgh, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
National Engineering Co., Chicago, Ill

SAND SIFTERS
Great Western Mfg. Co., Leavenworth, Kansas.
Monarch Engineering & Mfg. Co., Baltimore, Md.
National Engineering Co., Chicago.
The Preston Woodworking Machine Co., Preston, Ont.

SAND BLAST HELMETS
Pulmosan Safety Equip. Co. Brooklyn.

SAND BLAST MACHINERY
American Foundry Equipment Co., New York City.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.

SAND MULLERS
National Engineering Co., Chicago, Ill

SAND BLAST ABRASIVES
George F. Pettinos, Philadelphia, Pa.
Globe Iron-Crush & Shot Company, Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND RAMMERS
Cleveland Pneumatic Tool Co., Toronto, Ont.

SHOT AND GRIT, SAND-BLAST
Pangborn Corp Hagerstown. Md.
Globe Iron Crush and Shot Co., Mansfield, Ohio.

SNAP FLASKS
American Foundry Equipment Co. New York City.
Damp Bros., Mfg. Co., Toronto, Ont.
Diamond Clamp & Flask Co., Richmond, Indiana.

SNAP FLASK JACKETS
Damp Bros., Mfg. Co., Toronto, Ont.

STEEL BANDS
Damp Bros., Mfg. Co., Toronto, Ont.

TUMBLING BARRELS
R. MacDougall Co. Galt, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio

VALVES
Cleveland Pneumatic Tool Co., Toronto, Ont.

WELDING AND CUTTING SUPPLIES
Dominion Oxygen Co., Toronto, Ont.

Why Don't You Write?

HARDLY a week passes that Canadian Foundryman does not receive copies of this paper returned by the postal authorities because of the change in firm names or the address of some whose names are on the mailing list. Sometimes complaints reach us of the non-delivery of mail matter. It is not till the receipt of such complaints or the return of the paper, as the case may be, that we obtain any knowledge of the changes or removals of persons or firms. The adoption of the co-operative spirit on your part by notifying changes would make things a good deal more pleasant for both parties. The MacLean Publishing Co. want their mailing list to be in such shape that they will be able to render the perfect service to their subscribers. There is a lot of valuable trade matter mailed by this company and if you don't receive it—well, the fault is entirely yours.

Metal Workers' CRAYONS

Sawed from purest Talc; medium hard, guaranteed free from grit. Equal to best imported product but lower in price.

Send for free sample.

H. H. Wood Talc Co., Mine Centre, Ont.

Head Office and Factory

Toronto	Montreal	Winnipeg
82 Richmond St. E.	131 St. Paul St., W.	259-261 Stanley St.

Patterns!

Phone Adelaide 5439

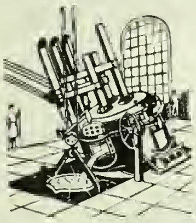
Put your pattern problems in our hands. Quality work and prompt service assured. Patterns made for all foundry purposes—wood and metal, models and aluminum plate work.

The A. J. HAMILTON PATTERN WORKS

120 Adelaide Street West, Toronto

MOORE RAPID 'LECTROMELT

STEEL FURNACES



The mechanical design of the Moore 'Lectromelt Furnace makes for simple, practical ease and rapidity of operation. A higher yield of good solid ingots and castings is insured on account of the absence of cold shorts, hot cracks, blow holes and surface defects. The regularity of the heats and rapidity of operation —speed up production and reduce foundry costs.

PITTSBURGH ELECTRIC FURNACE CORP.

(Makers of Furnaces for Steel, Iron, Brass, and Ferro-Alloys)

PITTSBURGH, U. S. A.

SAND-BLASTS

for every requirement STANDARD THE WORLD OVER

PANGBORN CORPORATION HAGERSTOWN, MD.

SAND-BLAST SPECIALISTS

P. O. BOX. 8508

AMERICAN

Molding Machines		Pattern Compound
Charging Buckets		Core Machines
Dust Arresters	A	Oven Trucks
Sand Cutters	EQUIPMENT	Steel Flasks
Snap Flasks		Sand Blast

AMERICAN FOUNDRY EQUIPMENT COMPANY

366 Madison Ave., New York City

ANGULAR GRIT

SCIENTIFIC METALLIC BLASTING ABRASIVE

Trade Mark

Adopt metallic abrasive instead of sand. Angular Grit will reduce your costs — one hundred pounds of grit will outlast five tons of sand. It cleans faster, requires less handling and less storage space, and reduces dust 80%. Write for samples.

Pittsburgh Crushed Steel Co. Sole Manufacturers

PITTSBURGH, Pa., U.S.A., Established 1888

Canadian Representatives: WILLIAMS & WILSON Ltd., Montreal, Canada

THE CLARK BLAST METER

indicates the number of cubic feet of air or gas passing per minute.

The Meter is furnished in any capacity desired, each one built to order and guaranteed in every respect. Several hundred are in use in smelters, steel works, coke plants, etc.

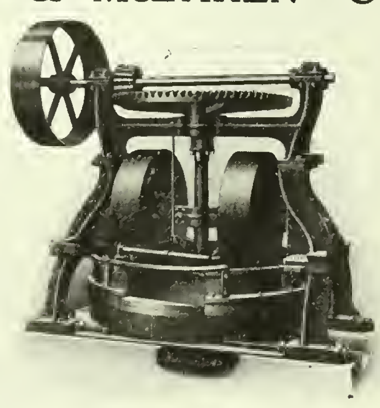
Booklet cheerfully sent—write for it.

CHAS. J. CLARK BLAST METER CO.

Gladbrook, Iowa.

PHILLIPS & McLAREN CO.

Sand Mixers-Grinding Pans



of all types and sizes for mill and foundry use. Also Jaw Crushers.

24th and Smallman Sts.
Pittsburgh, Pa.

INDEX TO ADVERTISERS

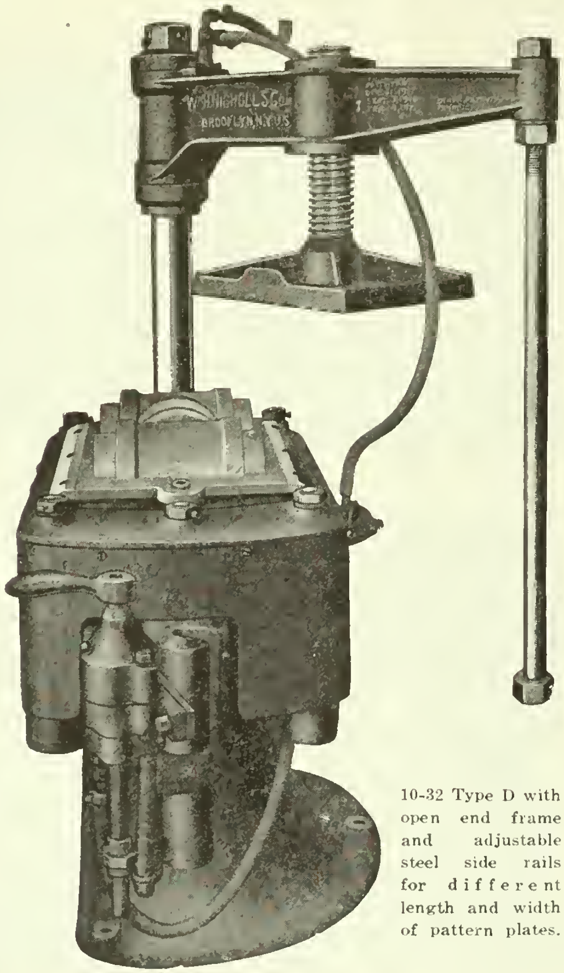
CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England.

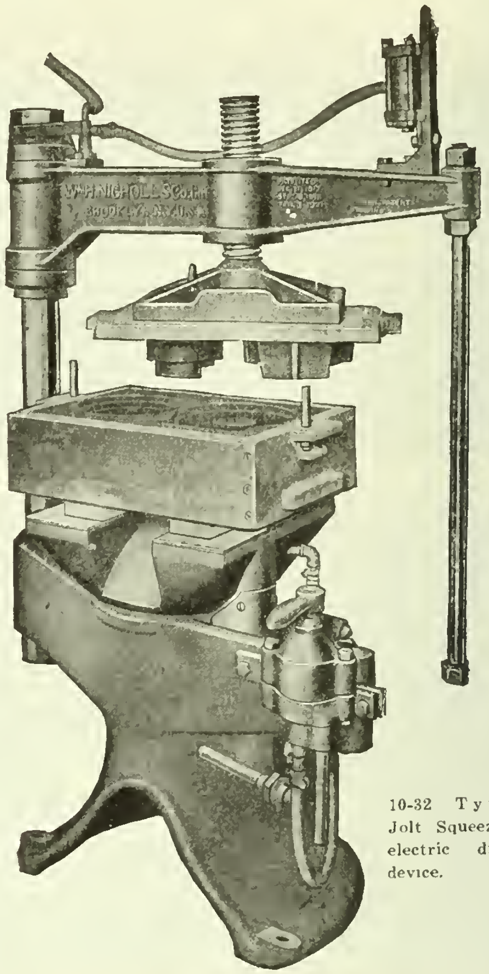
Vol. XIII Publication Office, Toronto, November, 1922 No. 11

NICHOLLS

MOULDING MACHINES



10-32 Type D with open end frame and adjustable steel side rails for different length and width of pattern plates.



10-32 Type E Jolt Squeeze and electric drawing device.

Better Machines—and Why!

These molding machines have no gears, toggles, cams, springs, canvass guards, small leaky valves, balance springs or complicated parts or adjustments, they are easiest on the operator and quickest to operate and most economical on air consumption. They have the least number of working parts; have a substantial base and an absolutely positive jolt without rebound. The heads swing in and out horizontally with the slightest effort; they are equipped with ball bearings top and bottom.

These machines contain many more features—write for full description.

WM. H. NICHOLLS CO., INC.

8-10 College Place **Brooklyn, N. Y.**

CLEVELAND
"Pistol-Grip" Chipping Hammer

Easy To Hold

Easy To Control

Also Furnished with "Enclosed" Handle, Outside Latch if Preferred

Cleveland Chippers are "Speedy" and efficient Tools. They operate without any "Recoil" and are easy to hold on the work.

They are "Ideal" for the Foundry as they are "Dust-Proof" and always on the job.

Cleveland Sand Rammers For Floor, Bench and Core Work
"Beat Them All"

For Speed—Power—Efficiency and Economy. Men like them as they have no "Recoil" and when running "lift" and "carry" their own weight. Try one and note their resiliency.

Bowes Air Hose Coupling
"Pleases Everybody"

Instantly connected or disconnected.

Absolutely "Air Tight" under all pressures.

All sizes in stock.

Write for Bulletins 51 and 52

Cleveland Pneumatic Tool Co.,
of Canada, Ltd.
84 Chestnut Street, Toronto
337 Craig St. W., Montreal

MOULDING SANDS

Years of experience in Mining and Blending Foundry Sands goes into every car of sand we load, without extra charge.

GEORGE F. PETTINOS — SANDS AND SUPPLIES — PLUMBAGO FACINGS

ALBANY SAND
STRONG SILICA SAND
SHARP SILICA SAND
MILLVILLE GRAVEL
FIRE SAND
LUMBERTON SAND
SAND BLAST SAND

R. J. Mercur & Co., Ltd., Montreal
Canadian Agents

GEORGE F. PETTINOS
1206 Locust Street
PHILADELPHIA

DIAMOND

MASTER FLASKS
PROMOTE SPEED IN MOULDING

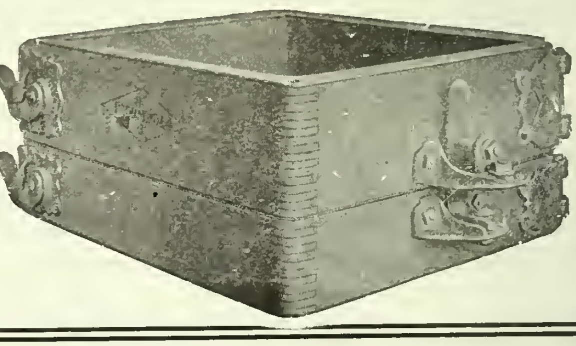
The light weight, ease and accuracy of operation of "Diamond" Equipment has shown many foundries an appreciable speeding up of work and a decided drop in overhead expense. It will do the same for you.

$10.00 F. O. B. Richmond, Ind.

Sold in Canada by

Dominion Foundry Supply Co.; Whitehead Brothers Company; E. J. Woodison Company; Frederic B. Stevens; Hamilton Facing Mills Co., Ltd.

DIAMOND CLAMP & FLASK COMPANY
40 N. 14th Street, RICHMOND, INDIANA, U.S.A.



Big Jobs

HUNDREDS of repair jobs that formerly kept rolling stock idle for weeks, and even months, are now speedily, economically and permanently effected by the oxy-acetylene process.

Dominion Oxygen Service contributes largely to the facility by which these jobs are completed. A service that places an unlimited supply of Dominion Oxygen and Prest-O-Lite Dissolved Acetylene of uniformly high quality, in safe, easily-handled cylinders with leak-proof valves, in the shops where and when it is needed.

We would appreciate an opportunity of quoting prices and telling you about our facilities for giving unusually prompt service.

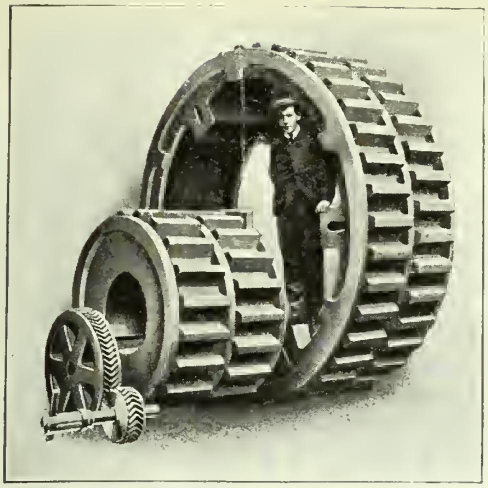
DOMINION OXYGEN COMPANY, LIMITED

Operating the Welding and Cutting Gas Division of
PREST-O-LITE COMPANY OF CANADA, LIMITED

General Offices: 80 Adelaide St. East, TORONTO.

Hamilton Merritton Montreal Oshawa Quebec Shawinigan Falls Toronto
Welland Windsor Winnipeg

D34

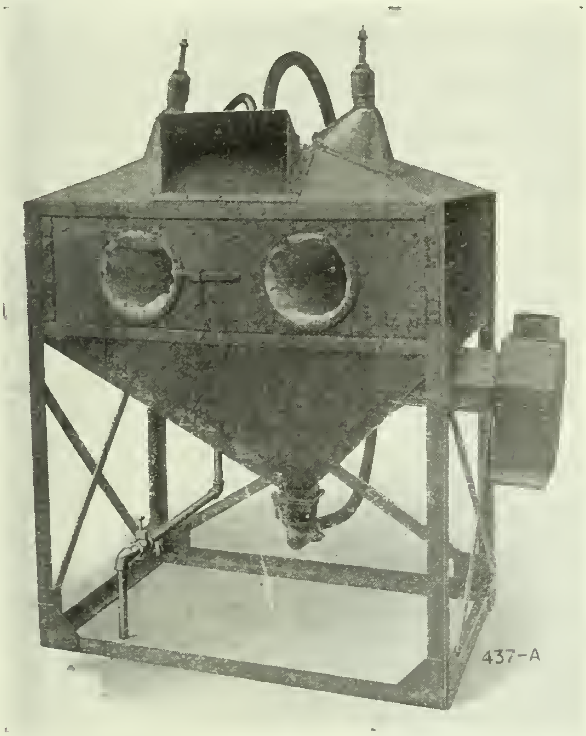


ALL IRON AND STEEL FOUNDRIES
SHOULD BE EQUIPPED WITH

Stewart Wheel Moulding Machines

WRITE FOR PRICE AND PARTICULARS TO

DUNCAN STEWART & CO., LTD.
LONDON ROAD IRON WORKS, GLASGOW, SCOTLAND



No. 30/48 Slyblast Cabinet

The name tells the size.

For quick cleaning of small, delicate or complicated parts.

Foot operated air valve, visible sand feed, adjustable sand supply valve, illuminated interior, connection for Dust Arrester.

Operates on 20 to 60 lbs. pressure depending on work to be cleaned and available air supply.

Ask us about it.

THE W. W. SLY MFG. CO.
CLEVELAND, OHIO
OFFICES IN ALL PRINCIPAL CITIES

Hamilton Facing Mills Co.
Hamilton & Toronto

Williams & Wilson, Ltd.
Montreal & Quebec

The Kawin Service for Canadian Foundries and Users of Castings.

THE SERVICE WE HAVE RENDERED MANY CANADIAN FOUNDRIES AS ENGINEERS, CHEMISTS, METALLURGISTS AND ADVISORS HAS RESULTED IN OUR MAKING MANY SPLENDID CANADIAN CONNECTIONS. We are proud of our record of achievement throughout Canada. We appreciate the confidence placed in our organization. OUR ENGINEERING SERVICE consists of planning and layout of foundries—based on practical methods. Assures you of low cost of operation costs and desired production.

Consult Us when Considering Alterations

OUR ANALYTICAL SERVICE consists of examination of Iron, Steel, Ferro, Bronze, Babbitt and Aluminum, Oils, Coke, Coal, Sand, Limestone, Refractories.

Advisory Service

Our Foundry Experts give advice on all Foundry Problems at Reasonable Rates.

Chas. C. Kawin Company, 307 Kent Bldg., Toronto

Also at Chicago, Cincinnati, Buffalo, San Francisco, Cal.

McLain's System

Helped

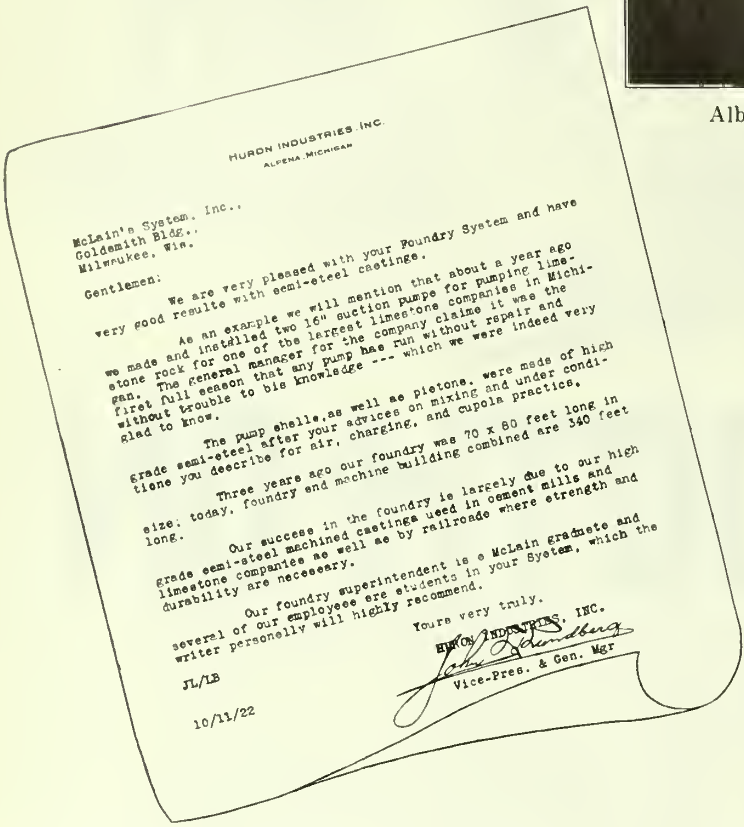
Increase Foundry

70 x 80 Feet Long

to

340 Feet Long In 3 Years

Albert Keller — David Sullivan (Supt.) — Rene Allade — John Lundberg (V.-P. and G. Mgr.) — John Collins



HURON INDUSTRIES, INC.
ALPENA, MICHIGAN

McLain's System, Inc.,
Goldsmith Bldg.,
Milwaukee, Wis.

Gentlemen:

We are very pleased with your Foundry System and have very good results with semi-steel castings.

As an example we will mention that about a year ago we made and installed two 16" suction pumps for pumping limestone rock for one of the largest limestone companies in Michigan. The general manager for the company claims it was the first full season that any pump has run without repair and without trouble to his knowledge --- which we were indeed very glad to know.

The pump shells, as well as pistons, were made of high grade semi-steel after your advices on mixing and under conditions you describe for air, charging, and cupola practice.

Three years ago our foundry was 70 x 80 feet long in size; today, foundry and machine building combined are 340 feet long.

Our success in the foundry is largely due to our high grade semi-steel machined castings used in cement mills and limestone companies as well as by railroads where strength and durability are necessary.

Our foundry superintendent is a McLain graduate and several of our employees are students in your System, which the writer personally will highly recommend.

Yours very truly.
HURON INDUSTRIES, INC.
John Lundberg
Vice-Pres. & Gen. Mgr

JL/LB

10/11/22

Mix That Experience of Yours with McLain's System

Thereby reduce costs by using more steel scrap and less coke—and eliminate casting losses.

Give your men a comprehensive knowledge of scientific melting and semi-steel. It will enable them to direct men under them more effectively—directly helping to solve casting and melting problems that arise daily.

PROGRESSIVE FIRMS employ one to six or more McLain men.

"A MAN IS NOT OLD UNTIL HE REFUSES TO ADMIT NEW LIGHT."

COUPON FOR YOU

McLAIN'S SYSTEM, INC.,
700 Goldsmith Bldg.,
Milwaukee, Wis.

Gentlemen:

Send full information on the seventh edition and 32-page Synopsis FREE. I am interested in

( ) Semi-steel
( ) Gray Iron
( ) Cupola Practice
( ) Blue print reading
( ) Crucible
( ) Converter
( ) Electric
( ) Open Hearth

Name ....

Address ....

....

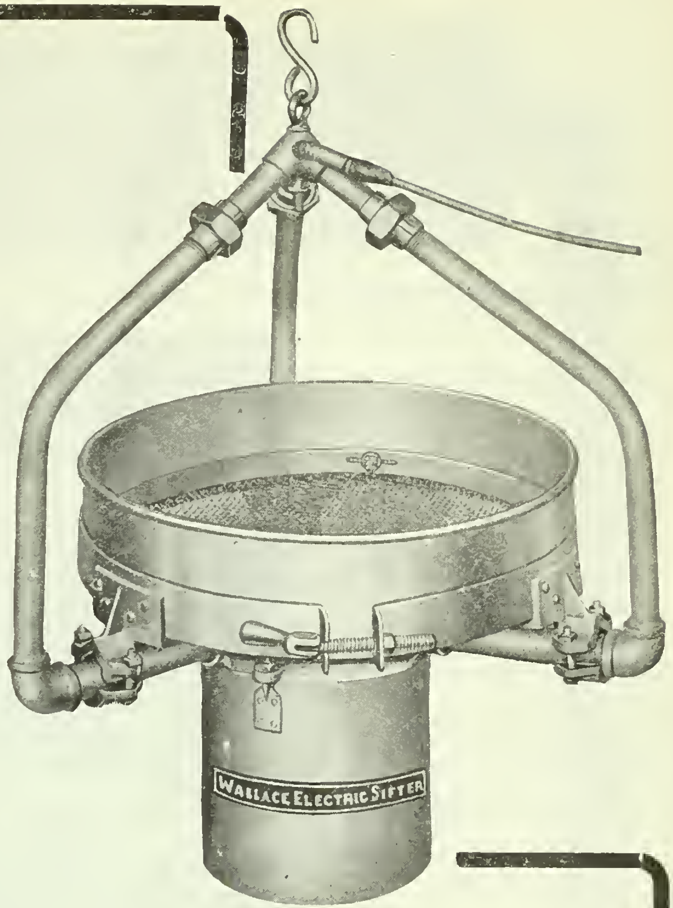
Firm ....

Position ....

11/22

SIFT

A Ton of Sand in 4 Minutes



With a Wallace Electric Sifter it is a simple matter to sift a ton of moist molding sand in 4 minutes through a No. 2 riddle. The sifter will sift faster than any man could shovel the sand into the riddle. It is such a great convenience that many foundries have installed enough of them to permit their men to sift directly over cores and trays.

The sifter is light in weight and may be hung from any kind of support or readily moved about the foundry. No exposed moving parts and no waste motion because the power is applied direct to the riddle.

The WALLACE ELECTRIC SIFTER

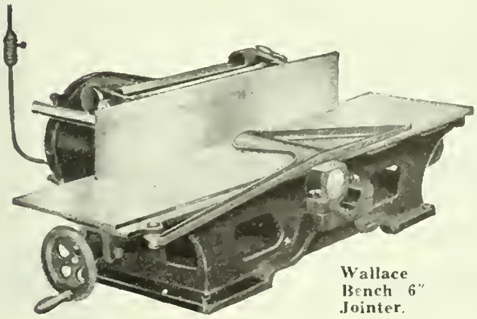
has this great capacity because of the exceedingly rapid vibratory motion imparted by a motor with a revolving eccentric housing. Your foundry could well make use of a number of these exceedingly practical machines.

Send for Bulletin No. 220-T and Prices.

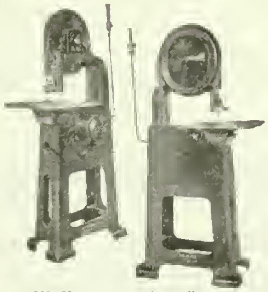
J. D. WALLACE & CO.

1420 W. Jackson Blvd. - Chicago, Ill.

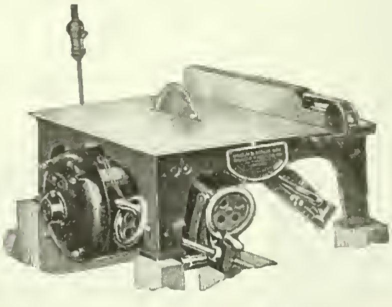
Most all Machinery Dealers Handle the Wallace Line.



Wallace Bench 6" Jointer.



Wallace Bench 16" Band Saw



Wallace Bench Universal Saw.

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Member of the "Audit Bureau of Circulations"

Established 1909
Published Monthly

Big Castings for One of Our Leading Industries

Paper-Making Machines Are Simple Looking, But Require Heavy, Sound Castings—Some Notes on Duties Which Drying Rolls Have to Perform

By F. H. BELL

IN THE last issue of this publication I endeavored to review some of the foundry work which I saw under headway at the foundry of the Dominion Engineering Co., Lachine, Que., as well as showing an end view of the plant.

In the illustration here shown in Fig. 1 will be seen a plan view of the foundry department of this works, which more clearly shows the position of the different units. Running lengthwise of the entire shop will be seen the pillars and track for the two powerful electric cranes which in my last article I mentioned as having, each, a capacity of seventy tons. One of these cranes, I might say, has a capacity of one hundred tons. As will be seen, the floor is divided into two parts, although in one room. To the right are the large ovens and pits for the loam work, while to the left are the ovens, pits and jib cranes and jolter for green sand work, while convenient to both are the three cupolas. It is not, of course, absolutely necessary to stick close to the strictly defined boundries of the two parts, since any of the pits can be used in a pinch for any kind of work within its capacity. The six pits on the loam end are quite pretentious in size. Five of them are each thirty feet wide, sixteen feet long and eight feet deep, while the sixth one is thirty feet wide, thirty-two feet long and eight feet deep. They are all built of reinforced concrete. In addition to the big cranes, there is a ten-ton hand-operated gantry crane for handling and placing cores, etc. On the left will be

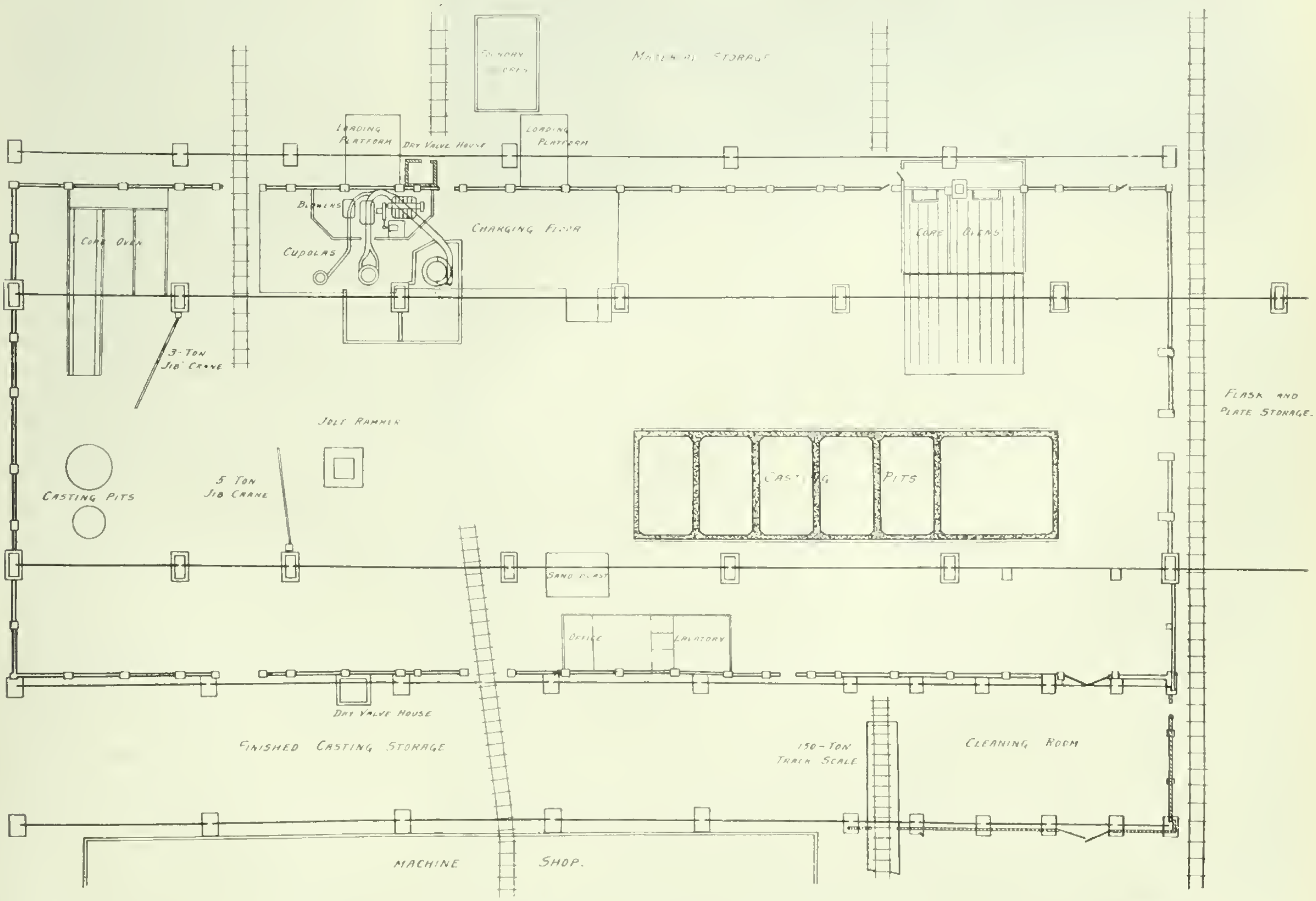


Fig. 1.—Plan view of foundry, Dominion Engineering Co., Lachine, Quebec, showing lay-out of different units of equipment.

seen two round pits. One of these is twelve feet in diameter, while the other is eight and one half feet in diameter. Both are sixteen feet deep. These are especially for jobs such as the paper mill drying rolls, which were spoken of in my last article, or any similar work. A perusal of this layout will convince the reader that it is an ideal heavy-work foundry.

In my last article I described mostly the water wheels which are poured in the pits shown to the right, but purposely omitted the paper-mill machinery until the present issue.

In Fig. 2 will be seen what might at first be mistaken for a number of water mains, presuming, of course, that the other ends would have sleeves or spigots to fit into the socket ends shown, but such is not the case. These are the paper-drying rolls, the molding and casting of which I propose to refer to, and while they may look simple and unpretentious in their present state, there are few lines of work which require more care on the part of the foundryman.

Group of large semi-steel Dryer Castings for Laurentide High Speed News Machine. They weigh approximately 31,000 lbs. each, and are 72" diametetr x 198" long. On several occasions six of these were made per week.

Since it is from a foundry standpoint that I am pretending to write, it will not be in order to digress too far from my subject, but in order to convince the reader that there is anything worthy of note in these seemingly insignificant bits of pipe it will be necessary to give him an insight into the work they have to perform when in use, and he will then be able to judge for himself what kind of a job it is. Not being a paper expert I will not attempt to describe the art of making paper, other than to refer to the part performed by the rolls. Paper can be made of almost any soft material which has a fibre to it, but in order to make it a commercial success it must be made from something which does not run too extensively into money.

First class paper may be made from flax or rice straw or rags, but the paper of commerce is usually made from wood, the pulp wood (as it is called) going through a long process of preparation requiring a dozen or more machines before it emerges in the form of pulp. If this pulp is to be sold as such to other concerns to be made into paper it requires to be dried to some extent and put into shape for shipping, but if it is to be used right up in the paper mill it is left wet; in fact so much so that it can be handled almost like a liquid, but before entering the final machine which converts it into paper it is of the consistency of oatmeal gruel. This wet pulp is put where it will come in contact with a travelling belt made of a felt-like material which picks up a thickness of pulp the same as any piece of felt would do if drawn over a kettle of oatmeal gruel. This belt with its coating of pulp is carried between these rollers in a similar manner to the linens in the laundry being put through the rubber rollers of the wringer. The first roller over which it travels is made of perforated brass. The belt presses it tightly against this in order to force the water out of the pulp and through the screen. After being drained of its free water it passes between the smooth iron rollers shown in Fig. 3, which are the ones shown in Fig. 2 but after being put in shape in the machine shop. These rolls form only part of the machine but a highly important part. Any variation from perfectly true must be figured in thousandths of an inch which means that they must be perfect. They must be perfectly round, perfectly straight, and perfectly smooth. They are built into the machine in a similar manner to the pile shown in Fig. 3, but all geared together and connected to steam pipes. A machine may have from seventy-five to one hundred and fifty of these rolls. The rolls here shown are six feet in diamter, sixteen feet and six inches in length and weigh between fifteen and sixteen tons each. These rolls may be two rows deep or three or four, and they may extend for any distance along the floor of the mill according to what grade of paper is to be made.

The pulp, as I was explaining, passes through the first stages, supported by the belt, but after becoming sufficiently set to hold itself together the belt passes out by another route and returns to the place of beginning, leaving the partly rolled pulp to continue from one roll to another, each one making it a little thinner and a little dryer. These rolls are kept hot by the steam which is continually circulating inside of them, and this dries the paper as it passes, but if there is the least unevenness in the rolls it will show on the paper. If a little sand hole happened to be overlooked it would make a lump. Of course the first few rolls would not be quite so particular, as the later ones would level off any defects if it was plain rough paper that was being rolled, but this is not always being done. Some machines roll tissue paper, while others are rolling card board. Some of the paper is made of three kinds of pulp, one on top of the other, so that when finished it will be of a different shade on one side from what it is on the other and then have a filling of rough stuff on the inside to prevent the two outside shades from contaminating each other. From this it will be seen that every roll must be exact.

An inspection of the rolls shown in Fig. 3 will reveal them polished to a shine, even in the picture. This shows expert workmanship on the part of the machinist, but it also requires that the castings be what they should be or the machinist could not do his part.

In The Machine Shop

The castings as they are shown in Fig. 2 are put in a lathe, and the end shown on the one marked E-14 is cut off until there is just sufficient metal left to counter bore it and form a socket as shown in the others. This part of the roll was cast uppermost and was intentionally higher than was called for so as to allow for dirty iron and to act as a feeding head.

While secured to the chuck of the lathe, and revolving in the steady-rest, which is the only way to hold it in its present state, this end is cut and bored as described, in order that it may fit the head shown in the rolls Fig. 3. It is then reversed and the other end faced off and bored, after which it is drilled to fit the heads which have been previously fitted up. The heads are securely bolted in, thus leaving the roll ready to be put on the centers of another lathe. The lathes required for this work must be very rigid as well as accurate, to avoid chatter while turning, but rigid as they may be, and careful as the machinist may be, it is impossible to put the required finish on the roll with a lathe tool.

Ground To a True Finish

When all that can be done with a lathe tool has been done, the tool is put aside and an emery wheel attachment is brought into service. This wheel is of the polishing variety and runs at high speed, and is fed along while the drum revolves, and when done the drum is perfectly polished as shown in the illustration, and in order to prevent the least corrosion it is given a coating of blue stain which makes the polish permanent. If the rolls should become rusted, they would no longer be perfect.

Molding and Casting

From the foregoing it will be seen that, although the casting may appear to be simple it should be sound. The brand of metal used and manner of melting are of prime importance, but the method of making the mold and pouring the metal into it are also important, while coupled to these is the necessity of making the castings at a profit. Another point to be considered is that if one hundred and fifty rolls had to be made for one machine and it took two days to make a roll, it would be a year before the castings would be made, and there are few customers who would wait for so long a time. Of course machines are not all so big, but any machine would have seventy-five or eighty rolls, and in order to get an order filled in anything like a reasonable time it is necessary to make each roll in a short time.

To the left in the plan view Fig. 1, will be seen two round pits sixteen feet deep already spoken of. These pits are made of concrete well reinforced with iron and with binding hooks, which are well secured into the concrete and projecting above the wall. These pits might be considered as the flasks in which the molds are made. The rigging for making the mold is the same as for any simple loam mold. At the extreme bottom is a heavy cast iron plate about two feet bigger than the roll that is to be made. This only requires to be a ring the size of the brick wall of the mold but with a cross bar from one side to the other in the center of which is the step for the spindle. The first mold can be built on the floor of the foundry and chopped down into the pit when finished, but there is nothing to be gained by so doing, as it can just as well be built in its place in the pit. The spindle is plumbed into place and secured by a temporary brace across the top and the sweep board of proper shape to make the straight wall and have a smaller section at the bottom for core print. This wall is swept up and loamed in the regular way frequently described in these columns. The bricks can all be backed up tight against the concrete wall. When the first one is done it has to be thoroughly dried before it can be poured, but all the succeeding ones can be made in the same mold by simply brushing off all the loose dust and sweeping on a finishing coat of loam when the mold will be as good as a new one. I say the brick can be backed up against the concrete wall, but this would only be in case the job fitted the dimensions of the pit, but in order to be able to make any size or length of roll, round sections of flask are used. These are piled on top of each other until a sufficient height is reached, when the bricks will be built into this made-up shell of a flask. Otherwise the work is the same as though the bare pit had been used. The outside wall of a plain loam job can be used indefinitely, but the inside or core is not so easily done since a six-foot diameter roll would shrink three quarters of an inch and relieve itself from contact with the outer wall but it would crush the core, and if allowance had not been made to permit of the core yielding it would crack the casting. This coupled with the fact that the inside is not straight but has two internal flanges on which to fasten the heads, makes it impracticable to do otherwise than to rebuild the core on each occasion, but by having extra foundation plates for the cores so that cores can be made ahead of time it is quite handy to pour a drum every day, as the heat of the brick will practically dry the little bit of loam which has to be added to the outside wall each time. All there is besides the outside wall and the core is to put a strap across the top and bolt it to the outside wall to prevent the core from moving and to hold down against the little bit of upward pressure which would be under the flanges in the core. There is no gate anywhere, excepting a number of pop gates in the runner basin which is placed on the top. This basin covers the entire circumference of the drum and extends over to one side, away from the blaze from the mold. The semi-steel with which they are poured is melted to a white heat to insure cleanliness and is poured very hard. It drops the entire depth of the mold but in such volume that it acts like a cushion and does not cut the mold. The casting is taken from the mold as soon as it is set enough to handle, thus giving the mold a chance to cool, sufficient to allow the molder to work inside of it in the morning.

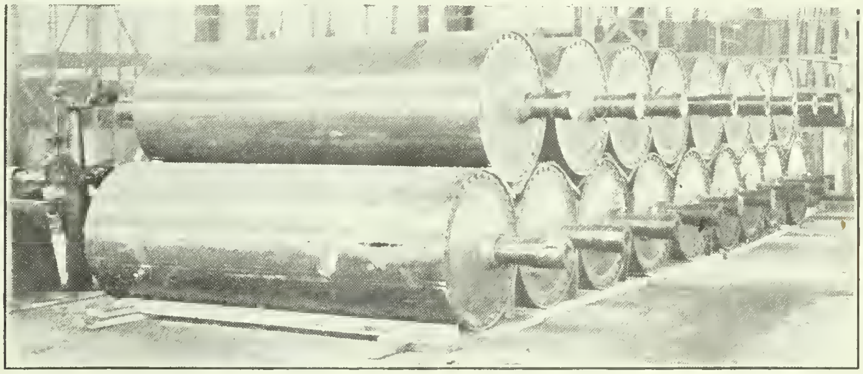
While paper making may not be to any great extent connected with the foundry business it is one of Canada's greatest industries, and as I have just shown, the machinery for producing it represents a lot to the foundry. It will therefore be of interest to note the importance of the industry not only to Canada but to the world. The following narrative taken from the C. P. R. bulletin, while primarily a boost for that road, will give an idea of how dependent the great publishing houses of the world are on our paper production:—

Forest to Newspaper in One Week

One week a stately growing tree flourishing in the primal fastness of some Canadian forest; the next, a newspaper, quickly perused and carelessly thrown away by readers in United States cities. This is the brief inner history of a great industry and the record of Canadian enterprise and transportation.

The Chicago Tribune faced a sudden newsprint shortage which demanded immediate remedying if their readers were to receive their newspapers as usual, a serious situation for any newspaper. Canada was the source of its newsprint supply and an S. O. S. was sent out to the Abitibi Company at Iroquois Falls in Northern Ontario.

The paper company passed the S.O.S. on to the Canadian Pacific Railway at North Bay and, as soon as they could be collected, forty cars were despatched over the Temiskaming and Northern Ontario Railway through two hundred miles of forest and plain to the mill. Their arrival was eagerly awaited and in record time the forty cars were loaded with a thousand tons of newsprint, a goodly cargo, but merely two days' output of the giant plant. Away to the border thundered seventy thousand dollars' worth of embryo newspapers. This was at five p.m. Friday, March 10th.



Group of finished semi-steel Dryers. These are loam castings, cast on end in special casting pits, of which there are two, one 8 ft. 6 in. dia., one 12 ft. 0" dia.; both 16 ft. deep.

A "Special" Rushed Shipment Through

A fresh engine was awaiting the special train when it reached the Canadian Pacific lines at North Bay and it continued on its way taking precedence over all but passenger trains and making, in fact, fast passenger time. Latterly it changed to the lines of the Michigan Central and arrived in Chicago on Sunday afternoon March 12th, having accomplished the trip of 1,059 miles in fifty hours. On Monday afternoon newsboys were carrying a part of the shipment about Chicago streets in the shape of newspapers. Readers in the great city received their papers just as usual, little realizing how close they had been to having the publication interrupted, and without a thought the papers were thrown away.

The wood which was pulped and latterly became the paper to constitute this expeditious shipment, had come to the mill but a few days previous to the urgent demand so that a spruce or pine standing in stately dignity in a Canadian forest this week, may, before the next elapses, be in the wastepaper baskets of a dozen cities of the United States.

New Process Secures Uniform Grain in Cylinder

Barrels Cast on Metal-Faced Cores. Uniform Crystallization Obtained. Average Cost Reduction of 75 Cents Per Cylinder Claimed for Metal-Faced Core Over Sand Core Method

IN an article published in a recent issue of Automotive Industries an idea is advanced which can be used to good advantage by foundrymen in other fields than that of the automobile. Every foundryman who has had experience with chills knows that different results are achieved by their use. They close the grain of the casting, and they make it harder. This is caused by the chill absorbing the heat from the melted metal, thus causing the metal to congeal, or set, before the combined carbon has had time to free itself. A light chill on a heavy casting will have very little effect on it, because after absorbing sufficient heat to bring it to the same temperature as the casting, the casting still contains abundant heat to anneal itself. Chills made in proportion to the casting to be chilled can be made to chill it to whatever extent is required—the heavier the casting, the heavier the chill should be. If a casting of uneven thickness is poured onto a chill of uneven thickness properly proportioned, the casting will be chilled evenly. If a casting of uneven thickness is made without chills, the lighter section will be harder than the heavier. If chills of proper thickness are used on the heavier section the casting should be of fairly even texture, but great care would have to be exercised in always pouring at the same temperature, and even then it would be difficult to have a chilled portion with the same grain as that poured in sand. With all these points in mind it is easily seen that to make a casting of uneven thickness and have the metal of uniform hardness the chill of uneven thickness would be the logical plan. There are other articles besides cylinders where uniform metal is required, and there are other cylinders which are of equal importance with that of the automobile motor. However, the automobile cylinder is one of the difficult jobs which the foundryman encounters and any method which will bring success in this class of work will be watched carefully by the shrewd foundryman engaged in any other line. Following is the story:

In the recent description of the new Buick models published in Automotive Industries July 27, it was briefly mentioned that a new foundry process was being employed in order to secure a uniform Brinell hardness over the entire internal bore of the cylinder. This process was recently invented by T. P. Greehow of the National Laboratory of Foundry Engineers. This invention covers a method to regulate gray iron mixture so as to give a uniform hardness test from the top to the bottom of the cylinder barrel. It was found after a series of tests on various mixtures that the Brinell hardness number of the test blocks would run at 235 or over on a barrel sample, while at the section covered by the water jacket, it would Brinell as low as 146. This, of course, is due to the annealing action of the thicker mass of metal, as well as the core in the water jacket space of the cylinder casting.

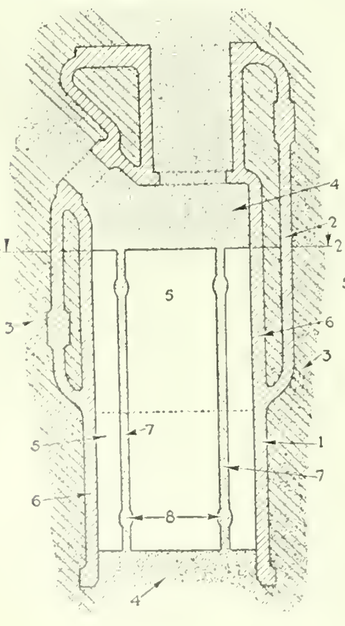
The variations of hardness found on samples taken from different parts of the cylinder castings indicated some interesting variations. For instance, Brinell tests taken on opposite sides of the walls cut from between two barrels disclosed the fact that while one cylinder in the pair gave a satisfactory hardness test, the other was below the specification limit. At the same time, flanges, bosses and other parts would be so hard as to necessitate the slowing down of the machine shop operations and the rejection of many cylinders that proved too hard to machine even at the reduced speed. The new method consists of casting the barrels on metal-faced cores and it is claimed that when finished, these present a remarkably dense, smooth surface, which indicates a uniform crystallization brought about by a thorough breaking up and even distribution of the graphitic carbon. Such a surface is also claimed to produce the best conditions for lubrication. The illustrations herewith show the core making details which are followed to obtain the results.

In the sketch, Fig. 1, is the engine cylinder casting of which Fig. 2 is the jacket wall. The casting is shown of irregular shape, illustrating the variable distribution of the mass of metal and consequent unequal heat retaining capacity.

The cylinder casting is shown, Figs. 1 and 2, as embedded within the usual sand molds 3, and containing a core 4.

In order to compensate for variations of a mass of metal comprising the casting, the metal plates 5 are varied in thickness throughout their extent. The segmental face plates 5 are shown with an offset or shoulder 7, thereby compensating for the annealing condition existing in the water jackets. To allow for contraction of a casting and to enable the face plate 5 to be readily removed from the barrel, they are spaced about 3/16 of an inch apart.

In order to locate the face plate in properly spaced relation for embedding in the core 4, the plates are provided



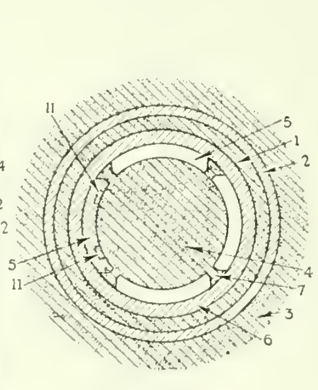


Fig. 1

Gasoline engine cylinder casting, showing one end jacketed while the other is not.

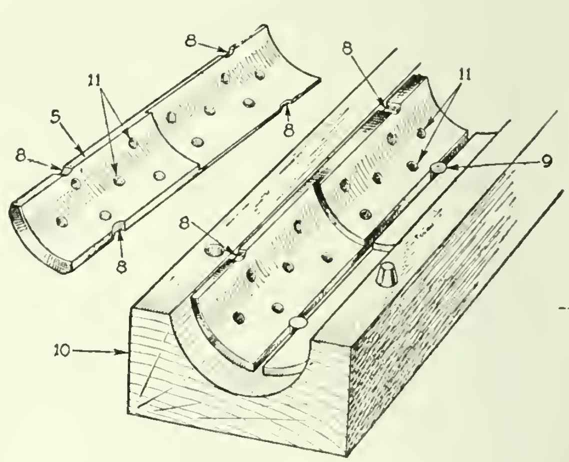


Fig. 2

Interior view of one room of the immense refinery of the International Nickel Company, Port Colborne, Ontario, Showing core box and chill. Note two thicknesses of chill.

AVERAGE BRINELL OF BARRELS CAST ON METAL FACED CORES AFTER FINISHED MACHINE OPERATION.

Section under water Jacket	190
Section under exposed part	200

AVERAGE BRINELL OF SPECIAL SOFT MIXTURE FOR EXPERIMENTAL TESTS.

Average Brinell under Water Jacket—Sand cast	99
Average Brinell under Water Jacket—Metal faced core	179

This test was applied to two barrels, (one sand core and one cast on metal faced core) of same cylinder block. Note that Brinell test raised from 99 to 179.

SPECIAL SOFT MIXTURE—ONE BARREL OF PAIR CAST ON METAL FACED CORE, THE OTHER BARREL CAST ON SAND.

Average Brinell under water jacket—metal faced core	210
Average Brinell exposed part—metal faced core	214
Average Brinell under water jacket—Sand core	126
Average Brinell exposed part—Sand core	137

	ANALYSIS SAND CAST	ANALYSIS METAL FACED CORE
Silicon	3.04	3.04
Sulphur	.093	.093
Phosphorus	.32	.32
Manganese	.73	.73
C. Carbon	.47	.16
Total Carbon	3.14	3.14

with accurate marginal notches 8; which engages locating pins 9, in the bottom of the halves of the core box 10. The pins 9 project from the bottom of the core box and receive the notches 8 of the face plate on opposite sides. The locating pins will leave depressions or holes in the core upon its removal from the core box. These holes are closed by being filled with core sand.

To afford anchorage for the face plate in the core, the interior faces of the plates are formed with a number of depressions as at 11. In addition the face plates are formed with draft or taper which further assists in holding the plates in place and prevents them from leaving the core while being handled.

After the barrels have been made the cores are run into the oven for drying. From the oven they are taken to the core cleaners, brushed off and handled in the usual way until they reach the assembly. Just before being assembled the face plates are quickly coated with a special preparation that causes the plates to leave the barrels easily, and which gives them a perfectly smooth surface. This special preparation, used in coating the metal faced cores, plays a most important part in giving the metal its density, Brinell hardness and machability. An examination of the physical structure of iron cast by this method shows it to be identical with air furnace iron. After casting the cylinder blocks are taken to the "knock-out," where the metal faced cores are removed without an extra operation.

Experiments conducted with a view of determining whether the time of removing the core made any difference, either in the density of Brinell hardness of the barrels, proved this to be a matter of no importance.

It is claimed that the cost of making a finished cylinder block on metal faced cores averages, at least, 75 cents per cylinder less than the cylinder cost on sand cores, this difference being made up by decreased cost of tool upkeep, increased speed in reaming and machining, and reduction of losses due to segregation, sand holes, leaks, etc.

Barrels cast on metal faced cores will not ream off, as there is no line of least or greater resistance due to variable density and hardness in the barrel.

COMPARATIVE BRINELL TESTS SHOWING THE RELATION BETWEEN CYLINDER BARRELS CAST ON METAL FACED CORES

Sand Cast Top	Sand Cast Bottom	Metal Faced Top	Metal Faced Bottom
170	187	196	196
166	187	196	196
156	174	202	196
163	179	202	196
143	179	196	196
143	187	196	228
144	183	196	228
146	187	202	212
163	183	207	212
183	196	207	217
159	192	212	212
163	196	207	217
166	207	217	212
179	196	207	207
170	207	207	207
166	192	207	192
166	179	207	207
159	202	207	202
153	192	202	202
163	187	202	196
159	183	207	196
Average Top	Average Bottom	Average Top	Average Bottom
160	189	203	206

In each of the above cases the metal cast against sand cores was barely machinable, while the metal cast against metal faced cores was machined at productive speed.

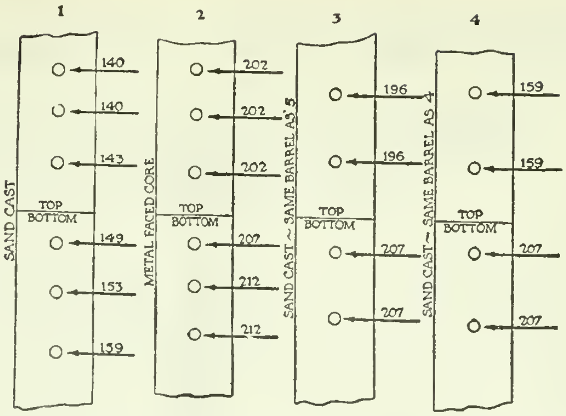


Fig. 3—The samples shown in Nos. 1 and 2 were cut from the same barrel. Sample shown in No. 1 was cut from the section of the barrel not covered by the metal faced core while No. 2 was taken from the section of the same barrel covered by the metal faced core. It will be noted that the Brinell test has been raised from a minimum of 140 to a minimum of 202. Nos. 3 and 4 indicate a wall cut from between two barrels cast entirely on sand cores. It will be noted that while the Brinell on one side of this wall representing one cylinder was very satisfactory, the other side of the wall representing the other barrel was not at all satisfactory as far as the Brinnell hardness was concerned.

ANALYSES OF SAMPLES FROM ABOVE SPECIMENS.

	Sand Cast			Metal Faced Cores Cast On		
Silicon	1.90	2.39	2.16	2.97	2.99	3.20
Sulphur	.123	.138	.125	.121	.099	.107
Phosphorus	.13	.13	.12	.13	.21	.14
Manganese	.70	.69	.82	.52	.66	.67
C. Carbon	.46	.37	.39	.10	.16	.07
Total Carbon	2.97	3.17	3.10	3.02	3.27	3.17

BE JUST

Act rightly and fairly. Don't take advantage of others. Neither allow others to take advantage of you. Be just in all your acts. Adopt the creed of the "square deal." It lays a solid foundation for success in any walk of life. Such a foundation never crumbles. You can go on and on and on building upon it. It always pays in the end to be fair and just.

AN EXPLOSIVE PIG BREAKER

A machine which merits more attention than it has received is a pig iron breaker, which derives its power from a small quantity of a safe variety of sporting powder. The maximum pressure of the gases is reached before the hammer moves to do its work, owing to the method by which combustion is regulated. Weighing only 2 cwt., the appliance is portable and is very simple in construction. The base is not a fixed design, being capable of alteration to take large sows. It consists simply of a platform, raised 4 in. from the ground, on which to slide the pig under the arch, which supports the operating cylinder. The hammer is cylindrical in shape, with a ball end, and tapered at the top to fit into the lifting plunger, which, by sliding down a slot cut in the side of the narrow portion of the cylinder, is made to lift the hammer, ready for the next break, after it has done its work.

The method of explosion is easily described. Cases containing the charges are fitted into a hole drilled through the plate of the loading mechanism, and after insertion the covering plate carrying the detonating pin is moved over into position. The release of a spring causes the pin to detonate the charge, arrangements being made for absolute safety in operation. The combustion gases separate the lifting plunger and the hammer, the latter being propelled at a very high velocity on to the pig, giving a blow sufficiently powerful to break the hardest variety. The downward movement of the plunger drives the gases remaining in the cylinder against the charge case, which is thus ejected.

The method is one of speed, for the whole operation occupies but a few seconds. Operating costs are low, and although only one break per charge is claimed, one blow will generally cause two or three breaks. The breaker is 15 in. high, 9¾ in. wide, and its base is 36 in. long.—Practical Engineer.

Casting Aluminum Bronze for French Coinage

Aluminum and Copper, Two of Our Commonest Metals, if Properly Mixed, Make an Alloy Which Closely Resembles Gold. Being Light Makes It an Ideal Material for Coins

BEFORE the discovery that aluminum was the most plentiful of the metals, it was used in conjunction with copper in the production of an alloy which had a very decided resemblance to gold. This alloy was known as Aluminum Bronze and was used chiefly in the manufacture of watch cases and certain kinds of jewelry.

During the last few years it has been demonstrated that there is more aluminum in the crust of the earth than any other of the metals. Extracting it from the earth and refining it took a lot of study and experimenting before it could be considered as a commercial success. Now aluminum bronze, which was formerly recognized on account of its beautiful appearance, only, has proved itself to be one of the most useful of alloys. Its tensile strength when properly mixed is very high, and its wearing qualities are difficult to surpass. It is used for heavy-duty gearing where it is called upon to do double duty in resisting wear as well as shock. But with all of these useful qualities, it still retains its beautiful appearance, and being among the lightest of alloys is an ideal material from which to make coins. It has its drawback, however, in that it is a difficult metal to keep from oxidising while in a molten state. This, of course, is the fault of the aluminum content which makes equal trouble when pure, as being light in weight it has not the weight required to keep the dross floating and the only means of getting clean castings is to keep the oxide on the surface where it formed and not let it get mixed through the melted metal.

The following article taken from "Engineer," will be read with interest as it not only tells how the French chemists got over the trouble in making coins but explains a method which could he used to advantage in many other types of casting. Following is the story:—

New French Aluminum-Bronze Money

The decision of the French government to replace the paper money notes at present in circulation with small golden-like coins of aluminum-bronze, calls attention to this new monetary metal. It is new in the sense that it is only just about to make its public appearance, though chemists and engineers were busy experimenting with it long before the war. Indeed, so far back as half a century Sainte-Claire Deville, recognising the brilliant future before this new alloy of aluminum, justly surnamed it the "French metal." Coinage metal, to be satisfactory, must fulfil certain conditions. It should be smart in appearance, virtually rustless, and difficult enough to manipulate to discourage the counterfeiter. Furthermore, in quality of resistance and value, a light metal is preferable to a heavy one. It should be easy to roll, yet sufficiently hard, must be able to resist attacks of the air, of the damp, of acids, of salts, and in particular must not change color near the sea. The new aluminum-bronze coins are said to fulfil all these varied and exacting conditions.

So far back as 1909, the French Ministry of Finance set up a Commission, at the head of which was M. Voille, to propose a likely metal to replace the old coins then in existence. M. Henri Le Châtelier, one of the members of this Commission, asked an engineer who specialized in the question of alloys, P. H. Gaston Durville, to prepare him bronzes of aluminum which should approach as near as possible to the metal of Sainte-Claire Deville, in order to try it from the monetary point of view. This skilful technician met with the greatest difficulties in solving the problem, but having founded, in the following year, the Society of Alloys and Forgeable Bronzes, he continued his researches on a larger scale. At length, with the aid of the chemist Hanriot, he succeeded in producing industrially a type of very hard alloy in the form of blank coins ready for the operation of stamping, and in September, 1920, M. Bouvier, Director of the French Mint, resolved to adopt aluminum-bronze to replace the dirty little notes now in circulation.

M. Durville is now preparing homogeneous ingots possessing a pretty greenish-gold color which can be polished as well as the hardest steels. One of the chief difficulties to be faced was the inclusion of scoria, air bubbles and other oxidised bodies when pouring the ingots. To overcome it, M. Durville invented and patented, in 1913, the apparatus herewith illustrated. It is composed of an ingot mould 1 and of a pocket or ladle 2 rigidly connected with each other by a communicating canal 3. These three elements, 1, 2, and 3, are kept in a straight line once they are brought together. The ladle and the canal are lined with a refractory material 4.

At the factory at Mouy-Bury, where the Society of Alloys and Forgeable Bronzes employs the Durville method, the alloy is melted in a crucible, its free surface oxidises and becomes covered

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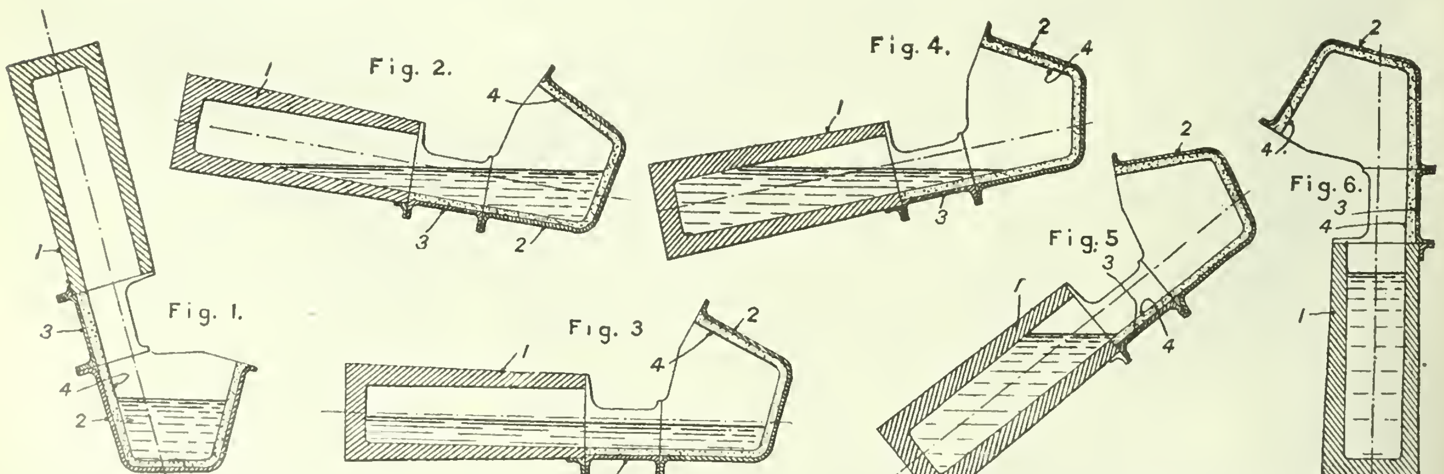


Fig. 1 Shows the three sections of the apparatus together with the refractory lining. Figs. 2-5 show the different position of the metal until it arrives in the ingot mold.

Apprentice Course on Brass Foundry Practice

Yellow Brass Usually Considered a Cheap Mixture, But if Copper and Zinc Are Mixed in Proper Proportions, Greater Tensile Strength is Secured Than From Copper and Tin

By F. H. BELL

WE have already seen that copper and tin, while forming most of the good varieties of bronze is also the oldest known alloy, since many prehistoric castings have been made from this alloy. Zinc, we learned, also alloys with copper and makes a useful composition known, familiarly, as brass. Bronze always seemed to have an air of importance, but the name "brass" always seems to savor of "cheap." This is a feeling which people have learned to respect, that when a brass casting which does not require many good qualities is ordered, yellow brass composed of two parts of copper to one part of zinc is expected. This kind of brass was good enough for ornamental work or where rust could not be allowed, but it was not very strong; had very poor wearing qualities and was not very high as an antifriction alloy, but like so many queer things in chemistry, a very little change in the formula, and that change in the opposite direction from what would be expected, makes a vast difference in the constitution of the resultant alloy. For instance, zinc which is, by itself, a hard, brittle metal and has always been used because it is cheap, if used in a very slightly increased quantity over the yellow brass formula will increase the strength of the alloy beyond anything which can be produced with copper and tin. Three pounds of copper to two pounds of zinc makes an alloy known as Muntz metal, and whereas the very best possible results which can be obtained from copper and tin would be about fifty thousand pounds to the square inch, Muntz metal has a tensile strength of sixty thousand pounds to the square inch, which is to say if a bar of Muntz metal an inch square is hung from one end it will sustain a load of sixty thousand pounds, or in other words 30 tons. Thus while copper and zinc make a cheap mixture, which has few outstanding qualities to commend it, it has one feature in which it excels—strength, if mixed in the proper proportions. This material goes by various names and is sometimes mixed with small amounts of other metals and still known as Muntz metal. Zinc, while a deoxidizer to other metals, is not free from oxygen when used as a leading metal itself and requires some other deoxidizer to purify it. Probably the best material is manganese.

Manganese is a metal, but as such it has no uses in its pure state, and is only useful on account of its effect on other metals. It is of a grayish-white color, hard and brittle. It alloys readily with iron, and is generally produced as an alloy of iron in the form of ferro-manganese, which is usually about 20 per cent. iron and 80 per cent. manganese. It is present in a small percentage in all grades of pig iron and is used extensively in the steel industry. It can, however, be separated from the iron and run into a mass by itself, in which case it will be heavily charged with carbon, unless the electric furnace can solve the problem of carbonless manganese. At any rate if manganese is to be used in the non-ferrous metal foundry, and no iron is required in the mixture, it is advisable to purchase manganese-copper which is prepared on purpose for the brass foundry. This is composed of 70 parts copper and 30 parts manganese. This mixes readily with either brass or bronze, and if used to any considerable extent will make the alloy hard. If manganese is mixed with Muntz metal to the extent of one-half of one per cent. it makes a sound homogenous casting which is exceptionally well suited for heavy duty work, particularly propellor wheels for sea-going steamers, since the salt water does not corrode the alloy.

An alloy which might be better in some respects, for this work, consists of copper, 54 parts; zinc, 40 parts; tin, 2¼ parts; and manganese, 3¾ parts. Manganese has a similar effect on brass to what it has on steel, while making the casting hard, and adding greatly to its tensile strength, it can be bent and rebent without breaking it. This characteristic makes it ideal for propellors, as a blade may strike a rock and be bent, whereas it might otherwise be smashed or else, by being unyielding, cause much damage to the engine. The blade may afterwards be put back in shape and be as good as new. A much lighter wheel can be made from manganese bronze (which is the recognized name of this material) than would be practicable from the best gunmetal bronze.

Any combination of metals containing manganese is known as manganese bronze, since manganese is the material which gives it its distinctive characteristics. Thus, a mixture containing 83 per cent. copper, 7 per cent. tin, 5 per cent. zinc and 5 per cent manganese makes a strong, and hard bronze which is well suited for heavy gearing, journal bearings, etc. This bronze would be superior to the former in some respects, as it would wear better and probably have better anti-friction qualities but it would not have as high tensile strength. It is, however, not very common practice to use manganese in connection with tin and copper mixtures, as it is quite a lot of trouble and is not thought to have any advantages over some of the more easily produced alloys, but it is worth knowing since many valuable discoveries have been made recently in non-ferrous alloying just through experimenting.

Iron has been successfully mixed with brass, by mixing in aluminum to drive off the carbon which invariably accompanies iron but which will not mix with copper. This is usually introduced in the form of tin plate scrap which is simply sheet iron coated with tin. When using this, allowance must be made for both the tin and the iron. Iron, in the most minute quantity has always been considered as detrimental to brass because, containing carbon, it would not mix, but would make hard spots which would resist any machine tool, and would, of course, be ruinous to a shaft if used in a bearing. By the introduction of aluminum this trouble is overcome, and good journal bearing can be made from scrap brass containing particles of iron, but brass containing aluminum can not be depended on for anything which has to stand pressure, as it is apt to be porous.

CASTING ALUMINUM BRONZE

(Continued from previous page)

with a film of alumina, which protects the parts of the bath below it from further oxidation. Once the alloy is melted the pouring must be effected without the slightest agitation. From the crucible the alloy is poured into the Durville ladle, which is then rapidly attached to the ingot mould. The whole apparatus is then tilted, as shown in Figs. 1 to 6, and the molten mass flows gently from the ladle into the four divisions into which the ingot mould is divided. As will be seen, the surface of the liquid bronze is kept horizontal throughout the operation. The alloy occupies successive positions without the least jerk, until it arrives at the ingot mould, where it solidifies. Its passage from one to the other is accomplished gently and evenly in spite of the rapidity of the flow. As soon as solidification has taken place the ingots are withdrawn, as shown in the right-hand engraving.

The aluminum-bronze leaves the factory at Mouy-Bury in the form of rectangular plates, each one weighing 60 kilos. to 70 kilos., which are then reduced to strips from which the coin blanks are stamped.

Business Papers Have Inspiring Field for Service

Their Duty to Preach Gospel of Progress Through Common Effort and Thought—Bring Business Man Into Touch With National Problems—Supply Him With Facts for Sound Conclusions

THAT they have a great and inspiring opportunity for service; that they are in a position to influence business thought and to direct it into proper channels; that they can bring home to industries their dependence upon each other, and their interest in the progress of the country as a whole—these were the duties and responsibilities which Lewis E. Pierson, chairman of the Board, Irving National Bank, declared business papers must recognize in any united effort looking to better business. It was, in fact, on this question of unity that he addressed editors of American and Canadian business papers recently at their annual convention in New York.

"Over a period of seven years," Mr. Pierson said, "business operated under conditions which were unhealthy because they were temporary and abnormal. The long period of expansion established false standards for labor and capital alike, and the abrupt transition to the depression of 1921 bred discontent and dissatisfaction among labor, and induced caution approaching timidity among industrial and financial leaders.

Encouraging Reaction

"Perhaps never in our history was the change from prosperity so sudden or severe.

"Examination of the facts and figures now available for the present year shows an encouraging reaction. Turn to the reports of industrial earnings, to the volume of business done, to bank loans, to investment buying, to stock prices, in short, turn to whatever index of events you please and you will find that the present year has shown a distinct and encouraging improvement over the corresponding period of 1921.

"Then compare the results for 1922 with the results for the pre-war year of 1913 and the conviction is borne home that this country, after the vicissitudes of the war, is establishing herself on a new normal level of prosperity which in many respects is above the pre-war level. It is true that in some instances profits are still lacking, but wherever the question of expense and overhead has been intelligently handled, our industries are either showing profitable operation, on a basis equal to or above the pre-war standards, or indicate that they are rapidly working into a position where profits will come shortly.

"Do not misunderstand these indications or these results as the precursors of a sudden revival of boom times. Do not imagine because we have successfully weathered one storm that the need for caution and patience has passed."

The speaker maintained that, in spite of the fact that the air was full of panaceas which proposed to solve existing problems and bring the world to a plane of greater prosperity, the man or nation that relied for a cure-all on anything but work, patience and still more work, was headed for disappointment.

"To make that work more effective should be the common aim. We cannot legislate our business into a state of blissful prosperity, but we can, and should endeavor to improve, wherever possible, the machinery of business. In that endeavor the first object should be to stabilize our business processes.

"The nearer we can come to a situation where our industries will proceed on a settled, and established level, and where the inter-relation of the various factors of our national business will l thoroughly fixed and universally understood, the better we shall be equipped to meet and deal with whatever new situations may arise.

"Sudden bursts of good times followed by abrupt periods of depression are not calculated to increase the real prosperity of a nation. They indicate that there is something wrong with the processes of national business and argue a weakness in the nation's economic structure which should be corrected.

Business on More Even Lines

"If we can arrange our affairs that the chart of national business will show a more even line, if we can fill in the hollows, and make the peaks less abrupt, it will be possible to plan our progress more intelligently and execute our program more surely.

"The business man has come to realize that the more evenly business is conducted, the better it is for everyone. And the obstacles to that orderly progress spring from a common source. Cast back over the causes of depression, over-production, strikes, ill-advised legislation, reckless competition, and you will be led to the conclusion that most of our difficulties proceed from the failure of the country as a whole to secure a thorough understanding of our national problems or from the inability or unwillingness of various sections and classes of the body politic to work together for the common good.

"The farmer, for instance, in seeking legislation which will give him higher prices for his wheat, is too apt to forget that this immediate advantage may react upon him in the higher prices which the industrial labor, which eats his wheat, must have for the products of the factory.

"The labor which advances its rate for building construction pays higher rent for its own quarters.

"The railroad worker seeking an increase in wages, thinks only of the immediate gain, without pausing to consider that he is at the same time increasing the price of every commodity that he uses, which the railroads transport.

Better Mutual Understanding

"Our greatest need, then, is for a better knowledge, a better understanding of each other's difficulties, of the underlying economic laws which regulate all business, and a greater readiness to work for the general good as the surest means of promoting individual welfare.

"If we can reach a point where there is general agreement on our national problems, and where we can bring th full force of an intelligent public opinion to the solution of these problems, we can stabilize our national business.

"If we can secure a crystallized national thought which will not hunt for vague panaceas, for prosperity through legislation, for any of the artificial expedients which attempt to over-ride the inexorable laws of economics, but instead will seek progress through intelligent effort and moderate but steady gain we can look confidently to the future.

"In the creation of this national attitude, the business papers have a great and inspiring opportunity for service. Reaching, as they do, the industries of the country, they are in a position to influence business thought and to direct it into proper channels. They can bring home to our industries, their dependence on each other, and their interest in the progress of the country as a whole.

"Week after week, and month after month, they can preach the gospel of progress through common effort and common thought. They can bring the business man into touch with all the national problems which affect him profoundly though indirectly. They can supply him with the facts which will enable him to form correct conclusions not only on his own business but on the business of the country as a whole.

"Finally they can throw their great influence toward the achievement of industrial understanding which will do for industry what the Federal Reserve system has done for finance.

"Until the creation of the Federal Reserve System the country was torn from

(Continued on page 27)

Interesting Talk on Metallurgy of Semi-steel

McLain System Described—Effects of Carbon and Manganese, Scientific Melting, Potentialities and Merits of Properly Mixed Iron and Steel—Nomenclature, Development, etc.

By DAVID McLAIN

READERS of Canadian Foundryman will remember that at the Foundrymen's Convention at Birmingham, England a few months ago, one of the chief speakers was Mr. David McLain of McLain's System Inc., Milwaukee, Wis. Mr. McLain's lecture was widely and favorably commented on, as well as being published in full in the British trade papers. Canadian Foundryman has been fortunate in securing the entire lecture together with the eight micrographs which show the points referred to in the talk. Following is the lecture:

Lecture delivered by David McLain at the British Foundrymen's Convention in Birmingham, England, June 1922.

The author may be thought to be presumptuous and egotistical in daring as an American to address Britishers on the science of melting iron and steel or wrought scrap in cupolas, as some have been doing it successfully for years, but please remember there is no more electricity in the world to-day than there was years ago, and until someone recognized the law by which it could be made of service, we knew but little of it. To-day the world is lit up by it. Just so as with the laws governing the science of melting steel scrap in cupolas, it took someone to prove that (1) steel scrap will not reduce total carbon; (2) steel scrap will not cause hard spots; (2) manganese is not a hardener; (4) high blast is not required; and although the author demonstrated all this twenty or more years ago, many writers to-day still claim steel will reduce carbon, and that is the main reason for the author's presence in Great Britain.

Writers for technical papers have advised foundrymen that it is necessary to use cold-blast pig, Hematite pig, cerium, titanium, vanadium and other alloys if they want to make quality castings.

Others have also been advised to melt iron in the electric furnace, the air furnace, and the open hearth furnace, and that quality iron, semi-steel and steel can be made in the electric furnace from cheap borings and turnings, but the cupola, in the hands of competent operators, can produce quality metal using steel and wrought scrap and other materials.

The cupola is considered a mysterious piece of equipment by many, who compare it to a bucking horse. They pose as authorities, but they "let George do it," and if the metal is good they take the credit but if it is of poor quality they blame George for it.

We believe this subject should be discussed to a satisfactory conclusion, as engineers and foundrymen throughout the world are guided by writers who should know that good semi-steel of ½ inch section is stronger and will resist hydraulic tests better than the average gray iron of 1 inch section.

Initially it may be as well to submit a few facts concerning the absorption of carbon by the steel from coke. When a boy, the author learnt that steel absorbed carbon from a facing sand containing coke. Open hearth steel of .20 to .30 per cent. carbon poured in gear blanks made of this facing were considerably higher in carbon on the exterior than the interior.

Taking advantage of this knowledge, the writer made tramcar wheels, using this coke facing on the tread, and after outwearing several sets of gray iron wheels, a large order was placed for similar wheels, being designated on the specifications as "chilled steel wheels." A steel rod in a blacksmith's fire showed signs of melting one day, and investigation proved that the rod had been in the fire frequently, absorbing carbon each time, until eventually the melting point was lowered to that of gray iron.

The ancients learned that a lump of iron ore thrown on an open fire, heated to redness and hammered, would develop into a spongy mass of iron that could be hammered to form implements of war, and modern chemists have analyzed swords made by the ancients, finding there was a 1 to 2 per cent. carbon present, this proving conclusively that wrought iron or steel will absorb carbon when heated in the presence of a carbonaceous fuel, so the writer experimented with coke and steel scrap in cupola mixtures, and was agreeably surprised to learn that steel will absorb up to 3 to 5 per cent. carbon, depending on the melting conditions. Synthetic pig iron would be impossible except that the steel turnings absorb carbon from the coke.

Making semi-steel, like other things, depends on knowing how. Take Hadfield's process of producing manganese steel. Without his formula and instructions, the "man in the street" could not make it. The author has met many who tried to make manganese steel, but failed in the attempt. Should manganese steel be condemned on that account? Similar conditions exist with semi-steel. Some people try to make it without the proper instructions, and the resultant metal being full of hard spots or blow-holes, they condemn semi-steel. One converter steel founder may make good steel using 60 to 90 per cent. steel scrap, because he knows how to melt it and control the sulphur, while his competitor may use 50 per cent. pig iron and still be unable to meet the specifications.

Rapid Advance in Metallurgy

For 50 years previous to the time it was discovered that carbon is absorbed from coke when making semi-steel, very little progress was reported by gray iron foundrymen.

The greatest developments in gray iron foundry practice are traceable to the introduction of steel scrap in cupola mixtures and common sense methods of mixing and melting; in fact, to one like the author, who has been on the firing line for approximately half a century it appears as if there has been 100 years' advancement within the past quarter century.

False Claims. — Many text-books, whether by technical or practical men, have maintained that steel reduces carbon. Chemists and metallurgists and practical foundrymen have at times agreed that (1) steel causes hard spots; (2) will not mix with iron; (3) is not a good thing to use; (4) requires a higher melting temperature, and that (5) manganese is a hardener. The use of steel in cupola mixtures was questioned on all sides but we learned that carbon will be absorbed from fuel by the steel up to the saturation point, and that manganese above a certain point aids in increasing the saturation point of iron for carbon.

The author has had hundreds of analyses made of both gray iron and semi-steel to learn whether there is less total carbon in semi-steel compared with gray iron, but there is not sufficient evidence to substantiate the claim that steel will reduce carbon.

Carbon Acts as a Medium

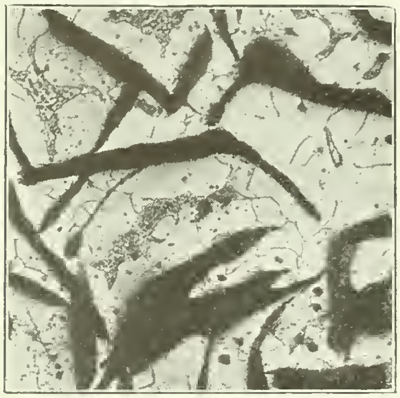
As carbon acts as a medium through which the other elements work, we do not try to remove it from iron, but learn to regulate it by studying the effects produced by silicon, sulphur, phosphorus and manganese. Study the effect of high and low blast on the carbons, and we use this knowledge to advantage when calculating mixtures for different castings that require softness, strength, fluidity or chill.

In melting iron in the cupola, carbon will be absorbed from the fuel when a mild blast is used, and the amount absorbed will depend on the amount of the carbon in fuel, the power of material to absorb carbon, and the temperature at which iron is melted.

This point alone should enable the student to realize the importance of becoming thoroughly alive to cupola operation. When poor coke and high blast are used carbon is lost, and as the total carbon is lowered, combined carbon increases in proportion to this loss.

When melting steel for cupola mixtures, high carbon coke is used for fuel. Coke, of course, can also be used in crucible melting, but in this practice the metal does not come in contact with fuel, therefore does not absorb carbon from it. On the other hand, steel melted in the cupola comes in intimate contact with the fuel, and owing to the very low percentage of the different elements in the steel, it has a strong affinity for them, particularly carbon.

When steel is heated to redness it begins to absorb carbon from the coke, and will continue until they both become incandescent when the carbon may be 5 per cent.; consequently, it automatically increases the temperature of the melting zone above that of the highest temperature necessary to melt gray iron, and blends with the balance of the mixture.


Micrograph No. 1—Thick end of wedge No. 1—Cast iron.

While it is claimed that the carbons are the predominating elements in iron castings, it is impossible to produce chill castings with high silicon, say, 2.75 per cent.; in fact, the skilful metallurgist insists that silicon be 2.00 per cent. or less to produce a very thin chill known as a "skin" chill on light castings.

The results of thousands of tests, both physical and chemical, lead one to believe that silicon is the controlling element, although sulphur, phosphorous and manganese play their parts along with the length of time the casting is allowed to cool in mold—all of which have a decided influence on the ultimate proportions of either graphite or combined carbon.

Keep and others claimed that the carbon in liquid cast iron is all in the combined form, but this, as well as the claim that steel scrap, when added to cupola metal, will reduce carbon, did not appeal to the author.

Condition of Carbon in Liquid Cast Iron

Keep claimed that graphitic carbon is only precipitated from the combined carbon by slow cooling, but the author has poured castings 1/16 to ⅛ inch thick of 2.75 per cent. silicon iron, when the metal sets or freezes almost instantly. If carbon in liquid iron is all combined, one could hardly expect a precipitation of the graphitic carbon instantaneously, but analyses proved that the carbon was practically all in the graphitic form, consequently the castings were soft.

On the other hand, take a 1.75 per cent. or less silicon metal—pour it into castings 1/16 to ⅛ inch, and the castings are hard with .50 or more per cent. combined carbon. It might be reasoned that the higher silicon iron may not have set as quickly as the lower silicon iron, but it is a well-established fact that the lower silicon iron will produce hard castings of thin sections, while the same sections poured of higher silicon will produce soft castings.

There is no graphitic carbon in steel or white iron because there is very little silicon, so no doubt Keep referred to steel or white iron—not gray iron—when he made the remark that the carbon was all in the combined form.

Semi-steel is the connecting link between iron and steel—combining the fine-wearing qualities of iron with a tensile strength of 19 to 23 tons when using 30 to 50 per cent. steel scrap in medium and heavy sections and we justly claim it is one of the most valuable products of the gray iron foundry.

Merits of Semi-Steel

Next to monkeys, man is the greatest imitator, so he watches other men charge steel scrap in the cupola, returns to his shop and does likewise, but not knowing the laws governing the operation he makes a mess of it. If the castings are passable, perhaps soon he is claiming to make semi-steel using half steel scrap.

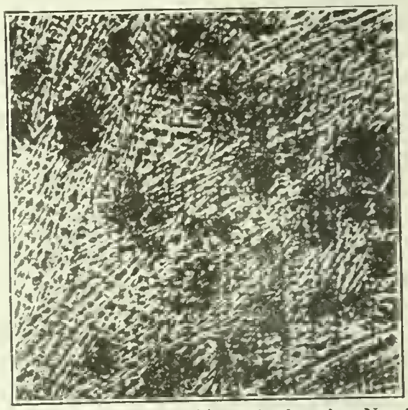
Now this half-steel claim recalls the story of the man who made a fortune through his famous rabbit pies. A competitor started, but his pies were not so good although he sold large quantities.

One day a friend asked him what he was using, and he said, "horse meat and rabbits." "Why," his friend said, "rabbits are very scarce, how do you manage it?" "Oh! I use a 50-50 mixture." "What?' his friend said, "half horse meat and half rabbit?" "Oh no, 1 rabbit mixed with 1 horse." And that about hits foundrymen who claim to use large percentages of steel.

It is only those who recognize the laws of good melting, the merits and advantages of semi-steel, and place themselves in harmony with them, who share the commercial benefits of strong, clean, homogenous castings and minimum losses—the delight of every true foundryman and engineer.

When properly made, semi-steel exceeds in both temperature and fluidity any other mixture melted in the cupola. The oxidation of the steel when melting scientifically is scarcely perceptible, and when steel is heated in the presence of coke it begins to absorb carbon from the coke faintly at low temperature, but as the temperature is increased and the steel and coke become incandescent, the steel absorbs large percentages of carbon and no longer is the steel of commerce, but a highly carbonized metal, and will melt before the pig iron in the same charge.

The use of steel in cupola mixtures was questioned on every side—but all such theories were exploded when it was proved that carbon would be absorbed by the steel up to the saturation point, and that manganese above a certain point assisted in increasing the saturation point of iron for carbon, as steel fuses perfectly and it has a strong affinity for carbon, silicon, sulphur, phosphorous, and manganese—proving to the metallurgical world that steel improves the product and that a new principle was discovered and applied with astonishing results.


Micrograph No. 2—Thin end of wedge No. 1.

Semi-steel is made in the same cupola —in the early or last part of the same heat with ordinary iron mixtures—no extra coke, special appliances, fluxes, or new equipment are necessary.

Mixtures may contain 30 to 40 per cent. steel on the bed charge—then follow with 20 to 25 per cent. steel—or begin with a small percentage of steel and finish with a large percentage. Flexibility of operation is only one of the many advantages of semi-steel.

Development of Semi-Steel

There is no subject so interesting to the foundry world to-day as semi-steel, and while a great many are trying to improve their product, they cannot believe that scientific principles govern the ultimate results,—even before the materials are charged into the cupola.

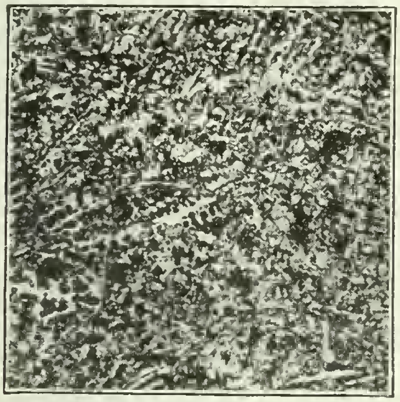
The object of this article is to give some plain truths about semi-steel. Many of the statements deal with historical facts dating back 50 years, while many points set forth may be disputed.

For 50 years or more foundrymen have added steel to iron in the ladle, while comparatively few melted slight amounts of steel in the cupola.

A patent was granted in England more than 50 years ago on a cupola mixture which contained only 10 per cent. wrought scrap. Major McDowell was quite successful in using steel scrap in castings of heavy section, but up to 1902 or 1903 the author could find no record of any man having used large percentages of steel in castings of light section.

The author perfected his formula of using large percentages of steel in light sections, and thus developed what he believes is a new metal in 1903—and instead of giving it a fancy name, called it "semi-steel."

The author does not claim to be the first man who used steel in cupola mixtures but no previous record has been found relating to the successful use of large percentages of steel scrap in castings of light section, and he has taught his process to foundrymen in various parts of the world since 1903.



Micrograph No. 3—Intermediate position, wedge No. 1.

Nomenclature

The name "semi-steel" has been abused for years, and will continue to be abused as long as men are satisfied with a mere superficial knowledge. A misapplied and misapprehended term is sufficient to give rise to fierce and interminable disputes; the term "misnomer" has often turned the tide of popular opinion; and while various authors have tried to place semi-steel on the list of misnomers, still the very fact that semi-steel was specified for shells by the Allied governments has placed it as a standard for foundrymen everywhere.

Many claim there is no such thing as semi-steel—that the steel loses its identity and is only gray iron. They forget that pig iron is used to make steel, and while the iron loses its identity, they call the resultant metal "steel."

Foundrymen and engineers have also been advised "cast iron is cheap, and heterogenous, therefore use heavier sections." This dictum has many followers, who are led to believe one standard mixture should be used for the entire heat, whether castings are light, medium or heavy.

Microphotographs of Wedges showing Fallacy of Casting Different Sections from One Grade of Metal

An experiment which the author believes will prove of great interest to foundrymen is what is called the "wedge test." A pattern is made 16 inches long, 2 inches square on one end, tapered to a feather edge 2 inches wide similar to a wedge. A few are molded and cast from several different mixtures, which correspond to the metal poured in various castings. The wedges are broken at sections which correspond to different sections of castings and the fracture noted. It will prove that it is a serious mistake to pour castings of different sections of one mixture.

It is learnt that the metal of ½, 1 or 1½-inch thickness produces a satisfactory structure for certain castings that require density to resist air, water or other pressure, it is well to have analyses made of the casting and duplicate mixtures for future work of that character.

To prove the importance of suitable mixtures for various sections, the author cast three wedge test bars 16 inches long, 2 inches square at large end, tapered to a thickness of 3/16 inch. Table 1 gives the analyses of mixtures, and it will be noted that one is a straight gray iron mixture and the other two semi-steel containing 10 and 5 per cent. steel, respectively.

Table 1—Analysis of Test Wedges

Wedge No.	Material	Si	S	P	Mn
1	Gray iron	2.50	.116	.70	.50
2	10 p.c. semi-steel	2.25	.116	.53	.53
3	25 p.c. semi-steel	3.00	.085	.40	1.05

These wedges were examined under a high powered microscope and microphotographs made of each at the largest end, 2 inches square, and the thinnest section, approximately 3/16 inches.

Microphotograph No. 1 was taken from the 2 inch square end of cast iron bar.

The massive black flakes are graphite; the black hair-lines or network are boundaries of white ferrite (pure iron) grains which form the main body or matrix. Here and there are islands of phosphide eutectic, which somewhat resemble a herring-bone structure.

Microphotograph No. 2 was made from the same bar as No. 1 at the extreme end where the metal is as cast approximately 3/16 inch. The magnification of No. 2 is the same as No. 1, but can one imagine it being of the same chemical analysis?

The light constituent is cementite with dark patches of pearlite. The metal was very hard and brittle; in fact, it was so hard that on the very thinnest edge it was partly chilled.

Microphotograph No. 3 was made from the same bar as No. 2 at the section where the white chilled part appeared to be mingling with the gray.

Microphotograph No. 4 was taken from the 2 inch square end of the semi-steel, 10 per cent. steel, wedge. While the silicon and phosphorus are somewhat lower than in the gray iron wedge, the black graphite carbon flakes are not so large and are surrounded by white ferrite, the latter bounded by a dark gray main body or matrix of pearlite. Here and there are small segregations of what appears to be manganese sulphide.

No 5 is a thin section of the same bar as No. 4—the extreme light end of wedge.

The light constituent is cementite, combined carbon, Fe_3C. The dark constituent is pearlite.

No. 6 is the same metal as Nos. 4 and 5, but at a point where metal was chilled and the white blends into the gray.

Light constituent is cementite; dark is pearlite.

No. 7 is taken from the heavy end of semi-steel, 25 per cent. steel, wedge. Compare this with No. 1 and note the difference in size of black graphite carbon flakes. The light patches at boundaries of plates are cementite, not entirely broken up. The main body of dark gray is matrix of pearlite.

It must be understood that the author does not advise semi-steel of this analysis for castings 2 in. thick, but in carrying out the main idea of showing structure of metal at different sections, it was considered best to include semi-steel of 25 per cent. steel.

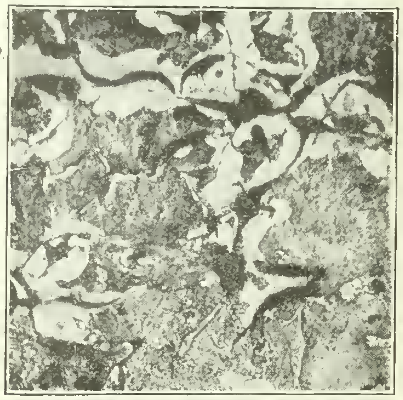
Microphotograph No. 8 was made from the same bar as No. 7 at the extreme furthest end, and metal is of the same analysis.

The light constituent is cementite; dark constituent is pearlite.

The semi-stel bar from which Nos. 7 and 8 were made is being used for small pistons which are about ⅜ inch thick when cast and 3/32 inch when machined.

Medium Phosphorus

While it is well to aim for the very lowest phosphorus in certain mixtures, yet there are foundrymen who cannot follow this suggestion, owing to the lack of materials low in that element, and in that event it should be remembered that, due to the small amounts of phosphorus in steel—.02 to .06 per cent.—the more steel used the less phosphorus in the casting.

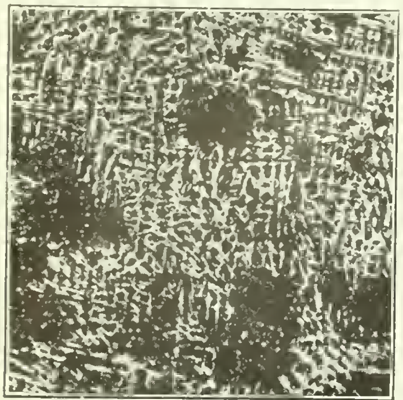


Micrograph No. 4—Thick end of wedge No. 2 —10 per cent. semi-steel. (Notice smaller graphite flakes compared with micrograph No. 1.)

The founder should aim to use every pound of steel scrap in his mixtures that the section to be poured will carry, especially for castings which must stand hydraulic or other tests.

Assume the mixture required is 50 per cent. pig and 50 per cent. scrap, and the estimated analysis of phosphorus is 1.00 per cent For every 5 per cent. steel added, take out 5 per cent. pig or return scrap, and this will reduce phosphorus .05 per cent. leaving .95 per cent. This is set out in table 2:—

Per cent. steel in mixture	Per cent approximate phosphorus in mixture
10	.90
15	.85
20	.80
25	.75
30	.70
35	.65
40	.60
45	.55
50	.50



Micrograph No. 5—Thin end of wedge No. 2.

The total carbon in semi-steel is higher, and the silicon, sulphur, and phosphorus lower, that is, with the same melting condition, than if the same percentage of the best charcoal or cold blast pig had been used instead of steel and with different melting conditions.

Steel breaks up the graphitic carbon flakes into granular form, because as the steel absorbs up to 5 per cent. carbon, a higher temperature is produced in the melting zone, and with the extremely high temperature and the metal being purer than gray iron, as it contains less silicon and phosphorus and more manganese, it is freed from impurities or gases, which insures a close-grained metal leaving no interstices for large carbon flakes.

It is not the carbons alone that make semi-steel better and stronger than gray iron but the lower silicon and phosphorus that may be used section for section, therefore many engineers and machinists prefer semi-steel.

Heretofore, if gray iron castings of ¼ to ⅜ in. section were to be cast, the founder would insist on high phosphorus iron, but there are thousands of tons of semi-steel made every day for light castings, with 3/16 to ⅜ in. sections, with only .20 to .40 per cent. phosphorus, and practical foundrymen are frank in saying it is the hottest metal ever seen.

Of course, the high manganese partly offsets the lower silicon and phosphorus, and with a fair percentage of combined carbon, one would expect the metal to be duller in the ladle and harder in the castings.

Steel in its descent in cupola is absorbing carbon from coke, and immediately before reaching melting zone it contains so much carbon (up to 5 per cent.) that it is not steel of commerce but a high carbon metal that mechanically increases its temperature even above that of the melting zone, which decreases its melting point. We claim most emphatically that when good melting conditions exist steel melts first.

Scientific Melting

When steel is used in cupola mixtures the entire charging and melting conditions must be changed, especially the manner of lighting cupola and preparing it for charging.

Steel mixtures must be handled differently than iron, both before and after melting. The cupola should be hot, and care is required in charging; in fact, the author's slogan for years was: "Semi-steel must be mixed with brains," because the proper tuyere areas and blast pressures have much to do with the success or failure of it.

It has been stated and the author believes it is a fact, that casting temperature is the secret of good semi-steel, for without the proper melting and pouring temperatures mixtures are not worth the paper they are written on.

Melting conditions in the steel foundry are approached at an entirely different angle from that of the iron foundry. In the steel foundry the melter in charge usually has many years' practical experience as a third and second hand and must have a knowledge of furnace contruction before given the opportunity to melt steel. But what a difference in the iron foundry!

The steel melter is told what percentage of elements is desired in his steel, and he calculates his charge accordingly. Later, as the heat progresses, he is guided by the actions and reactions taking place in furnace, and then decides what percentage of the deoxidizers (silicon, manganese or other alloys) is necessary to produce steel within the specifications, but he never attempts to melt steel in a cold furnace.

What a difference the author found when he first began using steel in the iron foundry! Like the majority of foundrymen of those days, he thought he knew all about a cupola, although his foreman claimed to know a great deal more, but between them scant attention was given to the cupola operation. Why?

The cupola was there. It melted iron every heat had done so for many years. Therefore the author believed the men in charge must understand the process, or, if they did not, the foreman would tell them. But did they? They knew how to melt iron, but the science of melting and the knowledge of cupola details was, and is, sadly lacking in many shops, even to-day.

High blast oxidizes a large amount of manganese, silicon and carbon. By lowering the total amount of carbon, a higher percentage of combined carbon is obtained which increases the percentage of oxygen, nitrogen and oxides—all of which have caused many to condemn semi-steel.

To make real semi-steel, one must be familiar with the fundamentals of scientific melting and the use of steel scrap in cupola mixtures.

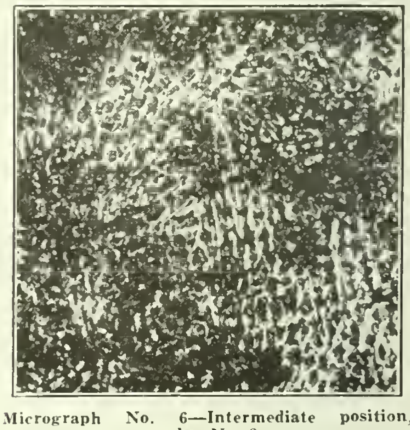
High carbon is more essential than high silicon in thin sections for all metal tested to air or water pressure, hence the silicon may be carried much lower than is possible in light sections of gray iron castings.

But how easy it is to make this assertion look absurd and untrue! The majority of foundrymen have never paid much attention to melting steel scrap in the cupola, and when doing so generally follow someone else's advice, who probably does not know any more about it than they.

They charge the steel in cupola without a thought concerning its melting, that is, they do not pay attention to whether high or low blast is used. If high blast is used the resultant metal is condemned. It has been proven that while steel could be melted in any cupola, still the metal was not to be depended on unless good melting conditions existed.

Annealed Semi-Steel

Some years ago a concern using both steel and malleable castings desired to produce a more satisfactory metal for their product. This company manufactured a line of tools for the hardware and automobile trade. An investigation proved that neither the best malleable nor steel castings gave them the desired results, and our study of the treatment given both malleable iron and steel castings led the author to believe a more suitable metal could be made of annealed semi-steel.



Micrograph No. 6—Intermediate position, wedge No. 2.

Annealed semi-steel is preferable to either cupola or standard malleable iron, for certain castings, as different percentages of steel may be used, depeneding on section and strength required. It may be hardened and tempered, and the tensile strength is considerably greater than the best malleable iron.

It is the author's belief that anneal-

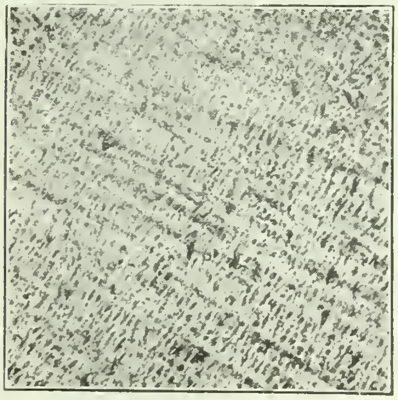
Micrograph No. 7—Thick end of wedge No. 3—25 per cent. semi-steel.

ed semi-steel will supersede cupola malleable for castings more than ¼ in. thick and even now several railroads are investigating its adaptability for castings over ½ in. section, as the tensile strength will run from 25 to 30 tons.

The cost of producing annealed semi-steel in comparison wth malleable iron will depend on the tonnage melted per day, but we believe that, ton for ton, annealed semi-steel would cost less than the best malleable iron.

Annealed semi-steel is white when cast. It is annealed from 3 to 7 days depending on sections, and recent experiments of heat treatments lead to the belief that quite a reduction of time will be experienced during the annealing period.

Foundrymen who lack sufficient confidence to make semi-steel instead of straight gray iron mixtures will hardly be expected to believe that some c the castings made are cast of annealed semi-steel. This metal is made in the cupola, and is very good for wearing purposes, but, of course, will not stand



Micrograph No. 8—Thin end of wedge No. 3.

shocks like alloy steels. Annealed semi-steel is very homogeneous, will twist or bend, may be hardened, will stand very high polish, and wears extremely well.

BUSINESS PAPERS

(Continued from page 22)

time to time by periods of depression brought on by unskilful and inadequate use of financial facilities. Though crops might be good and business fair, a sudden tightening of money could precipitate hard times by interrupting the ordinary process of business.

With the advent of the Reserve Banks, and the creation of a reservoir out of which money could flow to meet sudden emergencies, American business was freed from this danger and assured at all times of sufficient liquid funds to transact its operations.

The Reserve System did not create new stores of gold or silver; it did not make money out of thin air, or change the fundamental laws of finance in a single particular It simply perfected, and improved our financial machinery.

Improve Industry's Mechanism

In similar manner the nation should strive to improve and perfect the mechanism of industry. There is no more excuse for over-buying or over-production than there was for money panics. Depression through over-production proceeds from lack of facilities for adapting production to the demands of the market. Depression through over-buying proceeds from lack of facilities for ascertaining the public's wants and from fear of a sudden halt in supplies.

The Department of Commerce, has already attacked the problem of providing a proper organization for bringing the manufacturer, the retailer and the public into closer touch. The effort thus begun should be encouraged and supported. It is not enough that statistics and estimates should be available; the business man must be trained to use them and to base his activities upon accurate knowledge of conditions rather than upon his own surmise of what those conditions are. Here is a field where the business papers can be of supreme usefulness to their readers, and to the nation.

DIRECTORS OF AMERICAN FOUNDRYMAN'S ASSOCIATION HOLD MEETING

At a meeting of the Board of Directors of the American Foundrymen's Association held at Chicago, on Tuesday, October 3rd, a lot of important business was transacted. The report of Mr. C. E. Hoyt, the re-elected secretary-treasurer, is as follows:—

In the morning was held the final meeting of the old, or the retiring board. At this meeting reports of the secretary-treasurer, manager of exhibits, and of standing and special committees were received. The retiring president, W. R. Bean, was elected to honorary membership.

In the afternoon the new Board of Directors organized with President C. R. Messinger in the chair and twelve directors present.

The Board completed its organization by electing C. E. Hoyt, Secretary-Treasurer, R. E. Kennedy, Assistant Secretary, R. A. Bull, S. T. Johnston, L. W. Olson and Fred Erb, who, together with the President, Vice-President and Secretary will constitute the Executive Committee of the Board of Directors for the coming year.

C. E. Hoyt was elected Manager of Exhibits.

The directors provided for a permanent Board of Awards, consisting of the seven last living past-presidents of the American Foundrymen's Association, Inc., with the junior past president as Chairman of the Board.

An invitation was received from the Association Technique De Fonderie of France, inviting the A.F.A. to join with the foundrymen's associations of France, England and Belgium in an International Convention and Exhibit, in Paris, the first fortnight in September, 1923. The invitation was accepted and referred to a committee to be appointed by the president who will represent the A.F.A. and determine to what extent the association will take active part in the proposed International Convention.

Mr. S. Griswold Flagg III, of Stanley G. Flagg & Co., Philadelphia, Pa., was elected to fill the vacancy caused by the death of J. P. Pero.

Invitations for holding the 1923 Convention and Exhibit were presented and referred to a special committee for consideration.

Following adjournment, the special committee took under consideration the invitations for the next convention, with the result that a report was submitted to the Board of Directors, recommending that the next convention be held in the city of Cleveland, and by mail ballot filed October 23rd, Cleveland was selected, with Saturday, April 28th, as opening day for the exhibits, and Monday, April 30th, as opening day for the annual convention, both convention and exhibits closing Thursday, May 3rd.

It is proposed to make Saturday, the 28th, Cleveland Day for the inspection of exhibits.

The above is a brief summary of a meeting lasting from 10 a.m. to 7 p.m., during which time a great many association activities were reported on and decisions made regarding work for the coming year.

For further information, would advise that the Committee on International Relations, to whom the invitation from the French association for a joint convention, was referred, has been appointed by President Messinger and is as follows:

Chairman, H. Cole Estep, 2-3 Caxton House, Westminster, London, S. W. 1., England. Vice-Chairman, Stanley G. Flagg, Jr., Philadelphia, Pa., (President A.F.A. in 1908). L. L. Anthes, Anthes Foundry, Ltd., Toronto, Canada, (President A.F.A. in 1909). G. H. Clamer, Ajax Metal Company, Philadelphia, Pa. A. O. Backert, The Penton Publishing Co., Cleveland, Ohio. Franklin G. Smith, Osborn Manufacturing Co., Cleveland, Ohio.

Information re Core Prints on Patterns

Closing a Mold After the Cores Have Been Set is One of the Greatest Anxieties in the Foundry—Pattern Maker's Part is of Vital Importance

By JAMES McLACHLAN

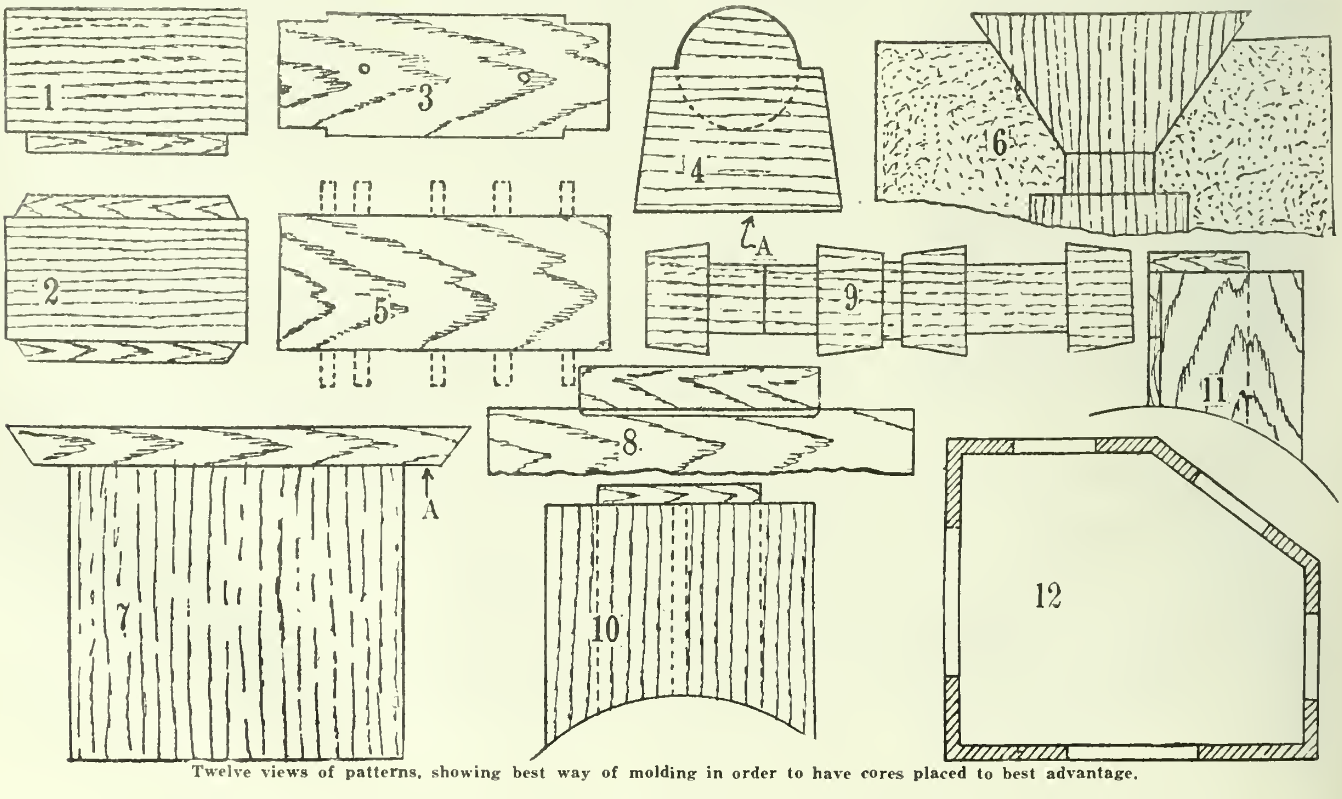
THE following article from "The Practical Engineer" covers a line of difficulties to be overcome which will be appreciated by others than juniors and apprentices. While the subject may at first appear simple, many a molder can testify to the trouble he has been put to over improper core prints which could have as easily been right, had the patternmaker known the foundry side of the question.

Prints are a never-ending worry to the apprentice patternmaker and also to the young journeyman. They lack that long experience which tells instantly the type of print that it is advisable to put on a pattern and its size and thickness. Thus the moulder gets a pattern printed quite unsuitably, and which gives him considerable trouble. It is not easy for the capable and experienced man to understand the difficulties of the tyro in this matter, real though they undoubtedly be.

Apart from the question altogether of whether a shell pattern or a block pattern with core boxes should be made for a certain piece of work, and except in some instances it is generally easy to decide the point, there are frequently parts of a pattern which can be more conveniently cored off. The moulder will generally prefer to make a core to mould a pattern in a three-part box, or even to take away a part with a loam cake Of course, there are occasions when the awkwardness of shapes is such that a great deal of labour would be involved in the pattern shop in fitting the print and making the core-box, and thus it is better to make the pattern a model of the casting and leave to the initiative of the moulder the getting out of the pattern by means of false cores or additional partings. In standard work, however, where a big number of castings will be required, whether it is for machine or hand moulding, too much labour cannot be expended on the pattern in order that no time will be lost in the foundry. A good pattern in reducing foundry costs soon pays for itself. A pattern which is suitably tapered, strongly made, and with prints into which the cores fit accurately, and is well finished—by which is meant that all corners are rounded, all corners filleted, and the whole work varnished smoothly —will almost, as workmen say, "jump out of the sand," and there will be no broken parts to be made up. The same can be said of core-boxes.

The question of top prints is one of those things on which there will never be complete agreement. The timid patternmaker screws them on, because he feels it relieves him of responsibility, and the practical moulder takes them off as dangerous and unnecessary. Sometimes, of course, they are useful for venting. The young patternmaker would do well to watch the moulding of his work, or, if he has not access to the foundry, he should examine carefully the pattern when it returns. In this way he will learn what prints the moulder has taken off. The examination of a casting invariably repays, because even the most skilful workman cannot hide his joints, and the casting shows where he has found it necessary or advisable to make his joints, and even the portions that he has cored off. It is, of course, quite customary for the moulder to make his own core-box in the mould. It is quite a common practice in some districts to supply a shell pattern to the foundry, not with any belief that it will be used as such, but because it is more cheaply made and the inside can be used as a core-box. Especially is this the case with large work.

In the accompanying diagram the writer has not concerned himself with constructional details. For instance, Fig. 1 represents a barrel which might be either staved or made with segments and of any size. It is shown with one bottom print, very slightly tapered. Some contend that prints ought to be the correct size at the top or face and larger at the bottom, while others make them the right size at the bottom and taper them smaller. There is something



Twelve views of patterns, showing best way of molding in order to have cores placed to best advantage.

to be said for both methods, but on the whole the former seems the better. When the latter method is adopted the moulder has to card or rub the core until it beds on the bottom of the print, and if he eases the core carelessly the print is not of much use for accurately setting it. If a top print was screwed on a pattern like Fig. 1 there would be very great danger of a crush when the cope was lowered. If the metal is very thin or for some other reason a top print is unavoidable it is wise to specially shape it as shown at Fig. 2, the correct angle of the print being cut in the core-box. If the patternmaker works very accurately the core will fit into the bottom print nicely and the cope can be lowered with assurance of safety.

Fig. 3 shows a barrel jointed longitudinally. Casting on end is generally preferred, because it simplifies venting and, of course, a head for dirty metal can be more easily left on; but it is not always possible. It is not so essential as a rule with the prints of a barrel moulded longitudinally to make the core exactly the same length as the distance between the faces of the prints, because the moulder frequently cuts away at the ends of the prints. When a print will not deliver from the sand, or even when it will deliver, it may be impossible to set the core without specially jointing down to the centre, and to save this the tail print (Fig. 4) is very commonly used. It is really two prints in one, and when the circular core is set a print core is placed in position on top of it. The edge A is, of course, the mould joint. Often the "tail" is filled in without a special core-box being made, but the core-box is easily and quickly made and saves trouble. The thickness of a tail print depends very much on the particular job.

Fig. 5 is an instance of a print which is not made the same shape as the drawing. It is often difficult and indeed impossible to make a print the proper shape or correct size because of ribs or bosses being in the way, but in this case it is a convenience for the moulder. It is a bearing core of a familiar design, the dotted lines indicating the shape of the core. Fitting the core into so many corners is an awkward job, and it is just as serviceable as a general rule to make the print one width in its entire length, the core-box being cut to suit. Many instances of a similar kind, where the moulder's task can be simplified by a little foresight on the part of the patternmaker, occur, and unorthodox methods by the skilful experienced man who does not ask himself the way in which it would usually be done, but the way in which it ought to be done.

Sometimes when a pattern is moulded on end the moulder prefers to drop his core in from the top of the cope, and especially is this the case if a core has to be hung in the top. Fig. 6 shows a conical print which emerges through the top of the cope. The core itself would sit on a bottom print and be dropped through the conical opening. Its length does not matter so much, nor does a core-box require to be made for the conical opening, as the moulder can easily fill in after the core is set. This is a form of coring a job which is not very often adopted, although it is applicable for many jobs, and while it simplifies coring up a job, does not present any peculiar difficulties. On the pattern the conical print would be dowelled to the circular print underneath, so that it could be easily drawn through the cope.

Fig. 7 shows a form of print which is used for small pistons. In such a job the core has to be hung in the top, or at any rate it is not advisable to cast it closed end up and with a bottom print. The simplest and most reliable print is that shown in the sketch. By the core resting on the ledge A it cannot sink, and thus the thickness on the bottom of the piston is assured. The tapered sides of the print keep the core accurately central. The danger, of course, in coring such a job is that if the core hangs a shade from the perpendicular the casting is spoilt. Practically everything depends upon the print and the core-box being made accurately.

There are often occasions when slots have to be cast on a face or parts have to be cut back so that the machined parts stand out. To cut those parts off the pattern may be difficult or objectionable, if the pattern is one that will be frequently altered, and then the less cutting there is of the body of the job the better. The obvious way is to core off such undercut parts with slab cores. A print which should be sufficiently thick to give a good body of sand is made and a plain framed up box will do for the core. The depth has to be the thickness of the print plus the depth of the slots (Fig. 8). Of course, this method would hardly ever be adopted if large numbers of castings were wanted and when there would be little possibility of the pattern ever having to be altered.

Fig. 9 represents a line of prints turned in the lathe with dowels. If a number of prints are wanted of the same size it is better to turn them than to pare them, and if the dowel is turned to fit a hole bored in the pattern a much better job is obtained than with simply screwing or nailing prints in position. In many cases it is very much quicker to turn prints than to pare them, although, of course, the cheapest way is to grind them at a sandpapering machine.

Figs. 10 and 11 show two similar forms of block prints for coring the space between the faces and ribs of feet and the pattern body. The prints ought to be tapered in their depth and made longer every way than the face under which they are fitted.

In making awkward shaped brackets where there are a good many cores through the outer metal, indeed, the metal may be merely a rim, it is often convenient to construct a block to the core sizes, which is really a print, and screw the metal to it. In other cases, such as the casting shown in section in Fig. 12, if the position of the circular holes is not very important prints are frequently not used, but the position of the cores marked on the pattern and the cores are then measured into position and fastened to the main core.

The subject of core prints is such a comprehensive one that it can only be cursorily dealt with in a short article. Experience is a great teacher certainly, but even the young craftsman, if he masters the general principles, should have the courage to apply them.

New Wood Filler for Pattern Makers' Use

Plastic Wood a Similar Innovation to That of Iron Cement—Sets Like Wood and Can be Finished With Wood-Working Tools

IN ENGLAND a new filler has been brought out which will be of interest to pattern makers. It is a plastic wood which acts like cement, only that it is wood. Foundrymen will remember the times we used to have trying to fill defective castings. Castings which are really defective should not be filled, but there are many castings which are as good as the best only that they have dirty spots which make them unsightly.

Fillers which were formerly used were unsatisfactory because they did not look like iron to begin with, and as the casting aged and became corroded, the filler would show up worse than ever because it would not change its complexion with the rest of the casting. With the advent of real metal fillers this was all changed because the filler was the same shade as the casting, and as the casting became corroded or rusted the filler did likewise, with the result that no one would know that it had ever been there.

Wood Filler

This same difficulty has been facing the wood worker who has been forced to use putty, wax, plaster, or any kind of a filler that he could get hold of, but all of which were unsatisfactory.

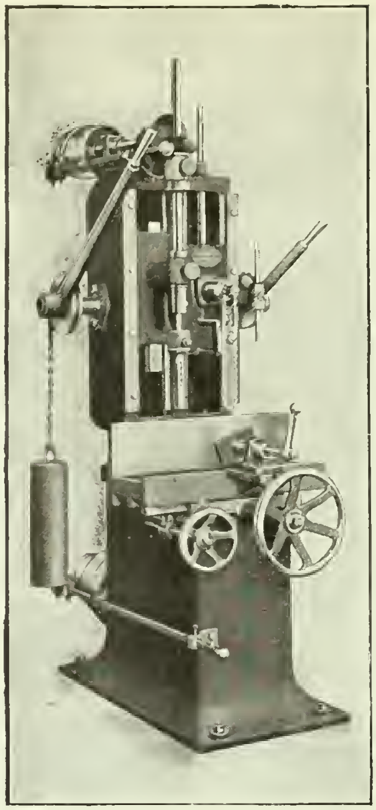
Wood in a plastic condition is somewhat in the nature of a novelty, the same as the iron filler was, but it is now a manufactured product that seems likely to prove invaluable in any trade where wood in its ordinary condition is used. This plastic wood can be molded by hand into any conceivable shape, and hardens on exposure to the air to a tough, solid waterproof substance similar in nature to wood but without any grain. When dry it is entirely free from any tendency to warp, crack, blister, peel or crumble, even when exposed to moderate heat. A slight amount of contraction takes place on drying, but the material adheres so firmly to its base that it does not draw away from anything to which it is properly applied. When dry it can be worked with ordinary carpenter's tools, or turned in a lathe. Articles can be built up entirely of this material, in thin layers, each layer being allowed to harden before the application of the succeeding layers, but where any bulk is required, some sort of a core or foundation would be advisable.

While this plastic wood is handy for filling defective spots on lumber in any capacity, one of its most useful fields is in the pattern shop. It can be molded by hand into an approximate shape and then when set it can be worked up to exact shape by the usual pattern maker's tools. Fillets, straight or curved in the most intricate manner can be modelled quite easily by the fingers or with a hollow tool.

Patterns From Broken Castings

It quite frequently happens that broken and worn castings are used for patterns from which to make new castings. In a case of this kind the plastic wood is ideal as it can be built on until a little flush and finished exact. In Fig. 1 will be seen a few examples of this kind of work, while in Fig. 2 is a frame pattern which required a fillet. When using old castings for patterns it is usually necessary to make up extra stock to allow for shrinkage, and also for machining. This can be easily built on. Plastic wood can generally be worked with the fingers to give a sufficiently smooth surface for molding, but when required the final surface can be formed in the lathe or finished with file and sandpaper. As the material is waterproof it has no tendency to drag the sand in the mold. This material is giving excellent satisfaction in Great Britain and it is the intention to introduce it in Canada at once.

MORTISING MACHINE

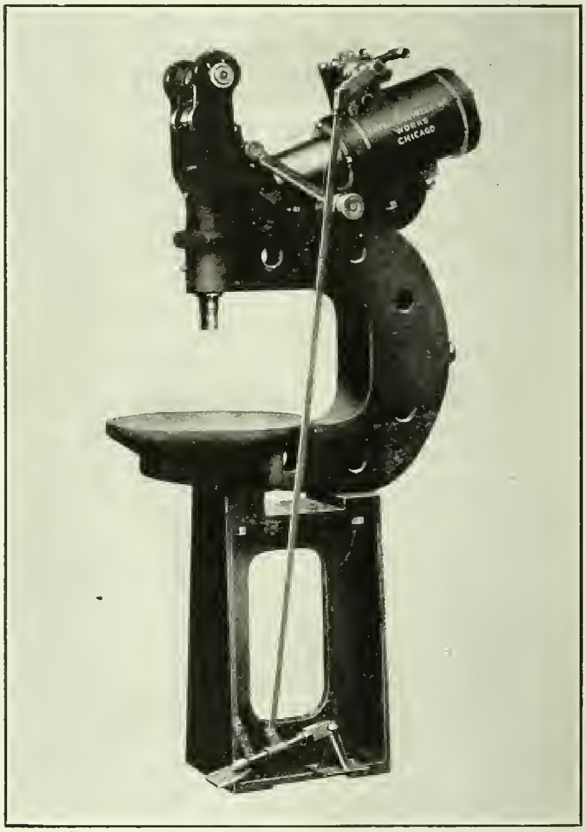


A chain and hollow chisel mortising machine designed to cover a wide range of operations, has been developed by B. Smith and Son of Bingley, Eng. The chain will mortise at one cut up to 1¼ in. by 3 in., or down to 3/16 in x ⅛ in. x 3/16 in. x ⅞ in. The chisel arrangement takes in chisels from ¼ in. sq. up to 1 in. sq., and by slipping out the chisel this part of the machine may be used for boring round holes. The horizontal table traverse is by rack and pinion. The cross traverse movement is operated by hand wheel and screw. Operator has full control of all levers and handles without moving from his position in front of the machine. The drive is entirely self-contained; a countershaft is fitted in the base of the machine, and from this the drive is taken by belt to the chain mortising spindle.

The driving belt is fitted with a simple device for making allowance for the tension of the belt being kept equal in all positions of the stroke, so that the machine can be operated from any position which may be found convenient in the shop. The chain mortiser has a device for taking up any slack which may develop in the driving belt. The hollow chisel side of the machine is fitted with an independent fast and loose pulley with separate belt fork, which enables this part of the machine to be put out of gear without having to push the belt off when this side of the machine is out of use. All bearings are of phosphor bronze and are provided with ring oiling arrangement. Each mortiser head travels 11½ in. and will make a mortise up to 7 in. deep at one stroke. Machine will accommodate timbers up to 12 in. x 9 in. This machine can be arranged for mortising hubs fitted with dividing heads, and canting arrangements for taper mortises. These machines are marketed in Canada by the A. R. Williams Machinery Co., Toronto.

TOGGLE AND LEVER PRESS

A pneumatically operated general utility press has recently been offered to the trade. The press can be equipped with various forms of platens or work-holding fixtures, so as to make it adaptable to such work as straightening, bending, forcing, marking, and many similar operations. The machine is built in a number of sizes ranging in capacity from 15 to 200 tons. The press is self-contained and is portable in every sense. It only requires a small floor space. An adjustable screw is used for locating the vertical position of the die. Adjustable toggle mechanism allows of regulating the length of stroke. The piston imparts to the die a gradually decreasing speed and an increasing pressure for each unit of piston and travel during the first part of the stroke. The last portion of the stroke is made at a uniform pressure. In bending and straightening operations it is possible to throttle the air supply so as to apply just sufficient pressure to deflect the work the desired amount. If the die travel is stopped by contact with the work at any point within the uniform pressure stroke the pressure on the die is a known predetermined amount in proportion to the pressure in the air line. When used for marking, embossing, forging, etc., the pressure can be regulated by means of the valve and maintained at the pressure while that particular job is being performed. Made by Hanna Eng. Works, Chicago.



Pneumatic toggle and lever press.

Oxy-Acetylene Applications in Foundries

Cast Iron Can Now be Welded or Cut as Readily as Wrought Iron—New Foundries Should Have All Pipes Welded to Avoid Leakages

THE oxy-acetylene department in the modern foundry is now as much a matter of course as the pattern shop or finishing rooms. The blowpipe is the accepted tool for cutting off steel risers because of its economy and speed, and in all welding operations such as filling in of blowholes and building up of defective castings it is indispensable as a source of saving and especially because the oxy-acetylene weld, being free from hard spots, contributes to ease and finish in machining.

Repair of broken castings, while not so important in the foundry as elsewhere, because patterns are usually available for making new castings and because the material costs are not so high as in completed machinery, is nevertheless quite common wherever castings can be welded more cheaply than they can be replaced. This is frequently the case and has led to provision being made in most foundries for preheating whenever the welding is to be done in places where the application of a welding heat will set up stresses in the casting.

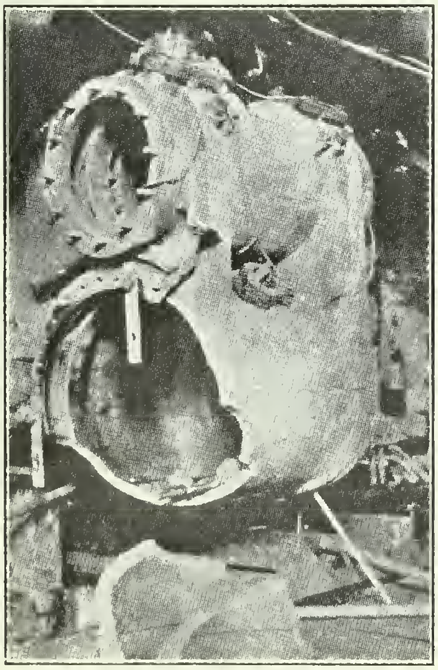
The modern foundry lends itself admirably to the production of quality acetylene welding. As a rule annealing ovens are ready to hand for the initial preheating; brick and coke are present for the building of ovens to provide final heating and annealing; and men who are experienced in the control of expansion and contraction are always at hand to supervise the work.

In many foundries special spaces are set off for the welding and cutting operations. An ideal procedure, where ample floor space is available, is to remove the castings from the moulds, take them to a regular place for rough cleaning, next to separate space for cutting off of risers, and finally to the grinders for finishing, where the defective castings are sorted out for removal to the welding division. A very orderly and simple mode of handling the castings is to use storage-battery trucks, cranes or monorail hoists carrying separate frames for the loads. In this way the frames may be loaded where the work is done, special work being kept to itself, and the loaded frames picked up and deposited in the spaces assigned for succeeding operations.

Acetylene may be supplied either by generator or cylinder, and oxygen may be taken from individual cylinders or from a pipe line fed from a manifold. In building new foundries it is advisable to use welded pipes for the distribution of gases, and to install welded air pipes and welded sandblast machines. Large diameter pipe used with either low pressure exhaust or supply fans should be welded to prevent leaks, which cause daily waste in the additional power required for the make-up at the fans. An extra half horsepower saved soon pays for the entire system, and welded pipe is both cheaper and better than riveted pipe.

Numerous controversies are constantly being brought before foundry managers as to the merits of various fuel gases and other than acetylene, and apparatus for using the gases. Founders generally are accepting the conclusion that the manufacturers of equipment and supplies whose business is old-established and national in scope are best qualified to advise the consumer and best equipped to render him dependable service. Unless the founder is equipped to conduct his own tests he can hardly do better than to accept the representations of the manufacturer who has an unquestioned record of success to vouch for the excellence of his product, efficiency of his process and his ability to serve the customer.

The many ways of handling oxy-acetylene applications in the foundry illustrate the wonderful flexibility and adaptability of the process. Mention has been made of the cutting of steel risers. This may be done on the foundry floor where the castings are poured, or the work may be done at a specially assigned place. Filling in of blowholes, building up defective castings and repair of broken castings have also been noted. There are numerous other things that can be done with oxy-acetylene or oxygen, such as scaling castings, cleaning ladles, burning salamanders, welding pipes, tools, structural shapes, machinery guards, etc.



Four stages in the repair of a broken locomotive cylinder, ranging from two inches to four and one-half inches in thickness.

In scaling castings a welding flame is applied to the refractory silica scale, which has a different expansion from that of the iron and cracks very readily just as does the enamel of a bathtub when heated, making it very easy to remove. This application does away with hammering and is a great time saver. It also tends to make easier labor conditions in the foundry.

Oxygen is used very successfully in clearing refuse metal and slag from electric and gas furnaces. It is much better than using bars and sledges in cleaning up, is easily and cheaply applied, and contributes to neatness in the foundry.

When any steel work is bent out of true it is surprising how easily it can be bent back into form by playing a large oxy-acetylene welding flame over the metal and using a sledge after a red heat is attained. This applies to both structural and sheet steel.

Worn out or broken steel parts can be replaced or repaired by welding. Excellent pipe joints can be made and should always be welded where vibration is very pronounced. Machinery guards, safety rails, etc., are being made constantly by welding. The value of oxy-acetylene for tinkering around any plant having a machinist is such that a separate portable outfit should be kept for the repair or emergency gang. The machinist who is assigned to this kind of work should be provided with literature on welding and cutting. He should also read the current numbers of the welding magazines to keep his foundry thoroughly abreast of the times in the late development in welding practice.

Many foundries assign production welders to do odd jobs. This almost always results in retarding production. It is much better to have a regular shop master mechanic look after the shop work. For most of the work which requires expert manipulation competent men are now generally available.

While repairs to broken castings occupy considerable time and floor-space they are sources of savings that more than justify the practice.

Nickel and its Process from the Mine to the Anode

Canada, Which Supplies Most of the World's Requirements of Nickel Ore, Now Does the Refining and Ships the Pure Metallic Nickel—Platers Use But Small Percentage

"I HAVE been asked to talk to you this evening on a subject which is undoubtedly of interest to you not only because it is intimately connected witht your everyday business but because of the fact that we are justly proud of our national resources. The Subject "Nickel and its Process From the Mine to the Anode" is, I am quite sure you can appreciate, very broad, so that I can only barely cover certain outstanding points and give you general though brief historical outline of the industry as carried on by the companies operating at the present time.

The following address delivered by C. A. Richardson of the International Nickel Company of Canada, at a meeting of the Toronto branch of the American Electroplaters' Society, was well illustrated with lantern slides which made it much easier for the speaker to demonstrate his points, but the subject matter is so carefully prepared that it will be easily followed and understood by anyone interested in metallurgy, mining or plating, without the aid of the slides. Mr. Richardson is a forceful speaker, and his knowledge of the subject of such vital interest to Canadians, covers a wide scope, but, as he explains his position, to prepare an address which would cover the subject as it should be covered would require many hours to deliver, and if put into print would fill a book of many pages. The essential features are, however, embodied, making it a really educational story.—Editor.

History

The Geological survey reported finding traces of nickel in the Sudbury district as early as 1856 up to which time this section of the country was little seen by the white man, with the exception of the officers of the Hudson's Bay Company, and the Geological Survey, whose travels were confined mostly to the immediate vicinity of the lakes and rivers and little was known of the minerals of the district. Twenty-seven years passed without further discoveries but during the construction of the Canadian Pacific Railway in 1883 many finds were made throughout the district and within a few years practically every deposit exposed at the surface had been staked. It might be said that the history of the nickel industry in Canada dates from the incorporation in January, 1886, of the Canadian Copper Company, now the International Nickel Company of Canada. The early discoveries were taken up for copper, only, the presence of nickel not being suspected, hence the inappropriate name—"The Canadian Copper Co."

In 1888, after a good deal of preliminary investigation, a smelting plant with one small blast furnace was designed and built at Copper Cliff.

It required comparatively little nickel at that time to swamp the entire world's markets, consumption being only about 1,000 tons annually, and it was only with the development of nickel-steel and its adoption for armor-plate by the United States Navy that the Canadian Copper Company began to get on its feet.

In the meantime, from 1890 to 1894, several other companies entered the field, operated smelters for varying periods and disappeared.

The Canadian Copper Company's operations, however, continued to grow in spite of difficulties and disappointments, financial, metallurgical, mechanical and economic. A contract had been made with The Oxford Copper Company, Bayonne, N. J., to take the entire output of furnace matte made at Copper Cliff, due to the fact that this company under the guidance of Col. Robert Thompson had perfected a cheap method of separating the nickel and the copper in the ore. When the first smelter was built in 1888 three mines were in operation, namely, Copper Cliff, Evans, and Stobie. These continued to supply the major part of the ore requirements, until about 1899. No. 2 mine was opened up in 1898 and Frood or No. 3 mine, in 1900.

In 1901 the construction of the Manitoulin and North Shore Railway (now the Algoma Eastern Railway) from Sudbury to Gertrude Mine provided an opportunity to develop Creighton Mine, which soon proved to be a very extensive ore-body.

This brings us to the formation, in 1902, of the International Nickel Company, which combined with certain other interests, the Canadian Copper Company, operating mines and smelter; and the Oxford Copper Company, operating the refinery. The former company, however, retained its name and identity until its amalgamation with the International Nickel Company of Canada, Limited, in 1918.

The inception of the new organization, in 1902, marked the beginning of a period of rapid development made possible by an ample supply of capital. The first step was the construction, on a new site, of a modern smelting plant, which was blown in on July 20th, 1904.

With the exception of the few activities, previously referred to, the Canadian Copper Company was the sole smelter of nickel ores in the Sudbury district until the advent of the Monel Nickel Company, which began to produce, in 1901, at Victoria Mines, Their new smelter at Coniston was completed in 1913.

The only other company to enter the field since 1901 is the British-American Nickel Company, whose smelter at Nickelton, and refinery at Deschenes, Quebec, began operations early in 1920.

Some idea of the growth and importance of the nickel industry in Ontario may be gathered from the following figures taken from Ontario Bureau of Mines reports:

Sudbury District

Ore smelted, 1890	59,329 tons.
Ore smelted, 1900	211,960 tons.
Ore smelted, 1910	628,947 tons.
Ore smelted, 1918	1,559,892 tons,

Nickel Deposits Elsewhere

Regarding other deposits than those found in the Sudbury district I may say that metallic nickel and nickel oxides are produced in small quantities by refiners of the silver-cobalt-nickel ores of the Cobalt, Ont. deposits. These ores, however, as you of course know, are not worked primarily as a source of nickel, but chiefly for their silver; the other metals being more of the nature of by-products.

If the mines of Sudbury, (Alexo, a small nickel deposit 150 miles from Sudbury) and Cobalt are excepted it can be said that Canada possesses elsewhere, no known deposit of nickel of economic importance.

The deposits which are the largest producers, after Ontario, are New Caledonia (a French possession in the Pacific Ocean) and Norway, while Germany and Austria possess a number of small deposits of various brands of ores that can be worked, only when nickel is high in price. The nickel resources of the United States are of little importance. When the Sudbury industry began practically the whole of the world's demand for nickel was supplied from New Caledonia. In 1900 about 65 per cent. of the world's nickel came from New Caledonia and about 35 per cent. from Canada. The world's output has increased five-fold since that time, and Ontario now produces over 80 per cent. of the whole. The production of Ontario in the last fifteen years has increased nine-fold. The production of New Caledonia by less than 20 per cent.

Uses of Nickel

Now, Gentlemen, just a word about the uses of nickel. The principal commercial application of nickel is in the manufacture of nickel steel, and this industry absorbed fully 75 per cent. of the total nickel production during the war and probably 65 per cent. normally.

Since the disarmament conference, you can appreciate that this percentage has been considerably reduced.

Besides it use in the steel industry it is used quite extensively as an alloying element with non-ferrous metals, principally copper.

About 15 per cent. of the production is normally utilized in the manufacture of alloys of nickel, such as cupro-nickel and especially nickel silver, the former series of alloys having come into prominence during the war. Nickel coinage and the electro-plating industries probably each absorb from 2 to 5 per cent. of the production.

Summing up the preceding facts, then, we may say, that the nickel of the world, exclusive of that sold as monel metal, is consumed in the following materials, and in about the following proportions:

Nickel steel 4	65 per cent.
Nickel anodes	5 per cent.
Nickel silver	15 per cent.
Malleable nickel	5 per cent.
Miscellaneous	10 per cent.

Now, after this brief outline we will get back to the main topic of extracting commercially pure nickel from its ores. There are three steps in the production of refined nickel, namely, mining, smelting and refining.

Although the smelting practice of the companies operating with sulphide ore of the Sudbury type is essentially the same, as well as the product (which is usually known as Bessemer matte), the refining of this matte to metal and the separation of the nickel and copper are accomplished by quite widely different processes, of which the following three are the most important:

(1) The Hybinette process, which is in operation in Norway, is essentially an electrolytic one. The matte is roasted to remove the bulk of the sulphur and leached with 10 per cent. sulphuric acid, whereby a large proportion of the copper with very little nickel is dissolved out. The residue is melted and cast into anodes, containing about 65 per cent. nickel and from 3 to 8 per cent. of sulphur, from which, by a combination of electrolysis and cementation of the copper by waste anodes, nickel cathodes and both cement and cathode copper are obtained.

(2) In the Mond process, which is operated in England, the Bessemer matte is first roasted and the copper removed in part by leaching with sulphuric acid with the formation of a solution of copper sulphate. The residue, containing nickel oxide with some copper oxide and iron, is reduced at a low heat to a finely-divided metallic powder. This is carefully protected from contact with the air, and carbon monoxide is passed over it at from 50 to 80 deg. C. At these temperatures nickel-carbonyl vapor is formed and is decomposed by passing it through a tower containing shot nickel heated to about 200 deg. C.; a layer of nickel is formed on the shot, and the carbon monoxide is regenerated and returned to the volatilizing towers. The nickel shot is alternately exposed to and withdrawn from the action of this gas, and in this way a series of concentric layers of nickel are built up around the original nucleus, like the coats of an onion. Mond-nickel shot may readily be distinguished by hammering it upon an anvil when the various coatings will be broken open, revealing its layer structure.

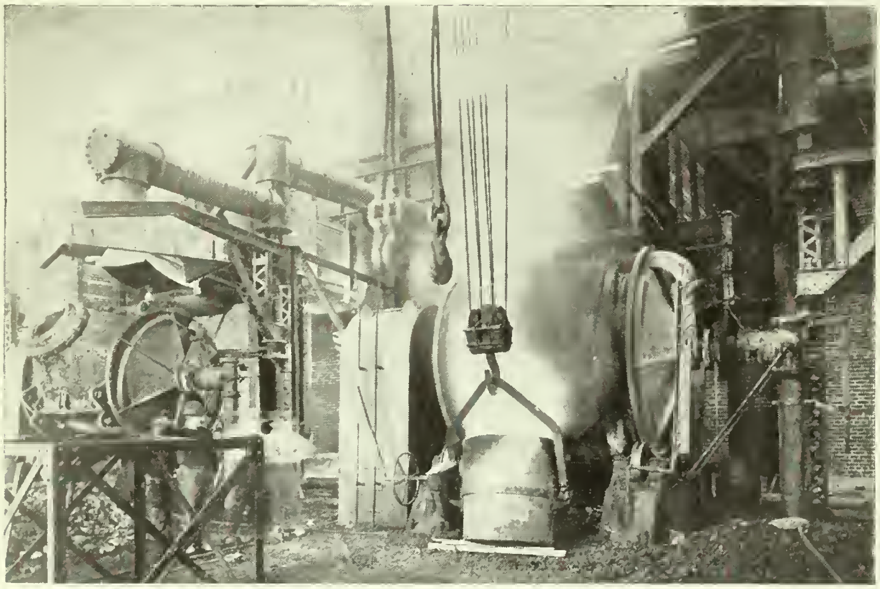
(3) The Orford process, which is the oldest process for the separation of copper and nickel, is being operated in this country. The Bessemer matte is melted with salt cake, or niter cake, together with coke, in the blast furnace. The sodium sulphide formed by the reduction of the sodium sulphide by the coke, together with the copper sulphide, forms a matte of low specific gravity. The product of the blast furnace is allowed to cool in pots, in which a separation occurs, the upper portion or "tops" containing the greater part of the copper sulphide, the lower portion or "bottoms" containing the greater part of the nickel sulphide. The "tops" and "bottoms" are readily split apart when cold. Several treatments are required to effect a sufficiently complete separation. The "tops" go to the copper cupola and converter, where they are blown to blister copper. The "bottoms," consisting, essentially, of nickel sulphide or matte, are roasted and leached alternately until they have been completely changed to nickel oxide. This is reduced with charcoal in crucibles or reverberatory furnaces to metallic nickel at a temperature above its melting point, such that the resulting product may be cast into ingots, or blocks, or poured into water to form shot. Electrolytic nickel is also produced by casting this reduced metal at once into anodes and obtaining pure nickel cathodes from them by electrolysis with an electrolyte of nickel sulphate.

The major portion of the ore is obtained for current operations from the

Interior view of one room of the immense refinery of the International Nickel Company, Port Colborne, Ont.

Creighton mine which is the world's largest nickel deposit. The ore deposit is located on about 18,000 acres of mining property owned by the company, mostly on the south range of the Sudbury nickel belt. The ore consists of pyrrhotite with chalcopyrite and pentlandite, together with some gange material, which is generally basic.

The ore deposit is a massive body and for several years mining was done by the open pit or quarrying method, but during the last ten years has taken place at depths which have now reached about 1,400 feet, and earlier methods of mining have been replaced by a system of main levels, from which the ore is mined in underground chambers, or



Copper converters at Port Colborne refinery, similar in appearance to those used in steel foundries, but built especially for refining copper.

stopes, and hoisted to the surface through a large main inclined shaft. I will not attempt to go into detail regarding underground operations as my time does not permit. It is into the hoppers at the top of the shaft house, or rock house, which is an immense steel structure 145 feet high, that the ore is delivered from the skips (or cars) which are hoisted up the inclined shaft at the rate of 2,500 feet per minute. It then gravitates through rock crushers and screens on three floors and is classified to various sizes on rubber sorting belts from which the waste rock is removed by the pickers. An electric elevator has been installed for handling men and material, and ore storage facilities are for 4,000 tons. Steel bins being arranged so that ore and waste rock is discharged directly into 50 ton hopper bottom railroad cars. The waste rock is conveniently disposed of in the old open pit. The method of treating the ore, as now practised, includes roasting, smelting in a blast furnace or reverberatory and converting matte basic crucibles. A typical analysis of the ore is as follows:

Copper	1.50
Nickel	4.00
Iron	41.50
S	24.00
S	17.00

On account of the high sulphur content of the ore, and for other reasons, direct smelting is not practicable, so that what is known as heat-roasting, is resorted to for the coarse ore, while the fines are roasted in a mechanical roasting furnace and then put through a reverberatory furnace.

The roast yard is situated about four miles west of Creighton mine. The ore is distributed over the beds by a specially designed unloading bridge; the only preparation required before beginning to build a bed, is to lay the wood necessary to start the roasting, while the finished bed contains about 5,000 tons of ore. The beds are lighted as soon as possible after the building is completed and usually burn for six or seven months, by which time the sulphur will be reduced to about 10%. The roasted ore is reclaimed from the beds by steam shovels, and loaded into 50-ton cars to be shipped to the smelter at Copper Cliff, thirteen miles away.

Smelting

The purpose of smelting is to slag off as many impurities as possible. There are eight blast furnaces at the smelter and a charge consists of coke with about ten times its weight of ore, and if necessary a small percentage of quartz and limestone to act as a flux and cause the slag to run more freely.

The blast furnace product flows into a chrome-brick lined settler. The slag overflows continuously at one side into 25 ton pots which are hauled to the dump. The matte is tapped off at intervals into seven ton ladles, which are transferred by rail to the converter building. This blast furnace matte averages about 5.78% copper and 14.63% nickel.

Converting

The converters are charged with 70 or 80 tons of blast-furnace matte and 5,000 to 6,000 lbs. of flux. The first blow is continued until a good slag has formed which may require an hour or more. The slag is drawn off from time to time and fresh matte charged until the converter is full. The finished converter matte is poured into cast iron moulds, subsequently to be broken up and loaded into cars for shipment to the refinery at Port Colborne, Ont. The typical analysis of the average matte is as follows:

Ni-Cu	77 to 79%
Sulphur	21%
Iron	.8%

The Oxford Process

The Oxford process of refining, used by the International Nickel Company of Canada, is the oldest process for the separation of copper and nickel, and there are three distinct products made in refining of the matte, viz;

(a) Metallic nickel.

(b) Black nickel oxide (content approximately 77.2 nickel).

(c) Blister copper.

The process is carried out in four stages which overlap to a large extent, so that the general flowsheet is somewhat complicated. The stages referred to are :—(1) Smelting; (2) wet treatment; (3) calcination; (4) refining to metallic nickel.

The Bessemer matte from Copper Cliff is melted with salt cake, or nitre cake, together with coke in the blast furnace. The sodium sulphide found by the reduction of the sodium sulphate by the coke, together with the copper sulphide forms a matte of low specific gravity. The product of the blast furnace is allowed to cool in salt in which a separation occurs; the upper portion or "tops" containing the greater part of copper sulphide together with the sodium sulphide; the lower portion or "bottoms" containing the greater part of the nickel sulphide. The "tops" and "bottoms" are readily split apart when cold.

Several treatments are required to effect a sufficiently complete separation. The "tops" go to the copper cupola and converters where they are blown to blister copper. The "bottoms" are roasted and leached alternately until they have been completely changed to nickel oxide, which assays about 77.5 per cent. nickel, 10 per cent. copper, 25.5 per cent. iron, .03 per cent. sulphur. The oxide is then sent to the nickel refinery to be reduced to metallic nickel, or it is shipped as nickel oxide.

Refining

The refining of the nickel is based on the principle of the reduction of black nickel oxide to metallic nickel by the use of carbon in the form of charcoal

PLATING AND POLISHING DEPARTMENT

Practical Articles, Useful Data, Descriptions of Machinery, Equipment, Etc., Used in Plating and Polishing Industry—Questions Cheerfully Answered

By WALTER S. BARROWS

Question:—Can you advise us with reference to suitable material for burnishing steel articles during plating operation in a mechanical plating machine. We have successfully plated small pieces and obtain very fine finish in these machines, but when pieces approximating 3 or 4 square inches are plated in same manner the finish is dull and more or less roughened by striking against one another. We have tried steel balls and find the deposit which accumulated on them eventually cracks off and the sharp edges of nickel scratch the work in process.

Answer:—Any metallic object used as a burnisher in the mechanical plating machine will acquire a deposit of nickel and cause more or less trouble. If the balls you are using are kept in a soda solution when not in use, they will remain clean and if rinsed and acid dipped when transferred to the machine they will remain in smooth condition much longer than if allowed to become dry and tarnished. Use rather strong hydrochloric acid, dip just prior to transfer, then rinse in cold water.

The practice of using a separate burnishing medium in a rotating plating machine is not regarded as being economical or practical for general run of commercial plating. It is advisable to employ a separate burnishing machine or barrel and use small nickel shot and soap bary or neutral soap chips; the advantage of the nickel shot lies in the non-corrosive property of nickel as compared to steel. The nickel shot acts splendidly as a burnisher for either nickel, brass or copper and requires less care to maintain a clean surface suitable for the purpose. We would suggest that you reduce the speed of the rotating plating cylinder to about 6 r. p. m., this speed will facilitate the production of a soft fine matte surface and thicker deposit in a given time, then follow by transferring to burnishing barrel made of, or lined with wood, and burnish to desired lustre with the nickel shot using a neutral soap solution as a lubricant. The speed of the burnishing barrel should be just enough to keep the work in a continuous rolling motion.

* * * *

Question:—We nickel plate certain pack hardened steel pieces direct on the steel and during the past summer have been quite successful. During the month of October, we began to experience some difficulties which are new to us and appear to be growing more serious. Our experience in plating tempered or pack hardened steel began last spring and we were not aware of any required changes in the treatment before plating as compared with steel stampings, etc. Our method has been to electro clean; rinse, immerse in 20 per cent. muriatic acid solution momentarily and then rinse in two waters and transfer to nickel solution. The deposit obtained is apparently the same as during the period when we were more successful, but, it is not adherent. Every attempt produces almost total failures, therefore we have now resorted to copper striking the steel, this helps us get around the trouble in a more expensive manner. We do not desire to continue coppering the article. It has been suggested to us that possibly hardened steel actually requires slightly different treatment than cold rolled steel stampings. We therefore appeal to your plating and polishing department editor for any information which may assist us in our endeavors to get at least 99 per cent. perfect deposits on this particular line of work.

The American Electro Platers' Society, Toronto Branch. President, E. Coles, 66 August Ave.; Vice-President, J. Young, 467 St. Clarens Ave.; Librarian, Harry Criswell; Secy.-Treas., C. Turner, 873 St. Clair Ave. Meets fourth Monday in each month at Room 2, C. O. F. Building, 22 College Street.

Answer:—With reference to case hardened steel in general the only difference in treatment in the plating department, as compared with ordinary cold-rolled steel stampings, is usually in the preparatory treatment prior to direct nickeling. Case hardened or tempered steel usually has a much finer, closer grain than even the best grade of cold-rolled steel. As you may possibly know, nickel has not as great an affinity for steel as for copper or brass and in order to facilitate the formation of an adherent coating of nickel directly upon the steel the surface is given a "bite" by immersion in a suitable acid either diluted or concentrated, depending upon the acid used and the hardness of the steel. Some platers employ diluted muriatic acid, while others prefer sulphuric or hydrofluoric acid. the latter being a very efficient acid for the purpose when mildly tempered steel is to be treated. Now, acids are less active in contact with steel when the acid is cold than when warm or hot. Acids mentioned above are comparatively slow in action when used at a temperature below 84 deg. Fahr. As the temperature of the acid is raised, the acid becomes more efficient as a "bite" with respect to steel. During the summer the average temperature of the acid may be about 90 deg. Fahr. at the beginning of a day's work, if only one acid is used. The temperature will not rise appreciably during the day unless a great bulk of metal is passed through it, or the metal is transferred from a warm or hot solution. If two acids are used in the dip, the tendency to become warmer is slightly increased as the acid is repeatedly agitated by the immersion and removal of the articles undergoing treatment. As the warmth of summer passes and the cool air of the fall season is noticeable, the natural temperature of the "bite" gradually lowers. October temperatures usually cause the first really marked drop in the temperature of the acid bite. Just as you have probably noticed at some time the crystals begin to form on the anodes in your pet nickel tank with the advent of October frosts and winds, the decreased efficiency of the acid dip takes place gradually and to the unsuspecting or over-confident plater the cause of failures is always remote from the acid dip. The duration of treatment remains the same when the acid is cold as when it is warm.

The above is a detailed expression of our opinion respecting your present problem. We may be wrong, but circumstances do not permit us to make absolutely definite statements with reference to such unseen cases. Warm the acid dip or increase the time of immersion. If the latter procedure is adopted we would suggest an increase in time of at least 2 seconds for every degree Fahr. the temperature of the acid has lowered since you were producing adherent deposits. If a lead coil can be conveniently placed in the acid crock, we would advise its use. A ¼ in. lead coil will suffice to heat a 20 gal. dip very satisfactorily. Use lower steam pressure from 5 lbs. to 30 lbs., and if time is valuable to you, heat the acid to approximately 140 deg. Fahr., decrease the time of treatment about one-third as compared with time given during summer weather. When you become acquainted with the advantages to be gained by use of the heated acid dip, you will find the study of variable temperature conditions throughout the plating plant a very fascinating and instructive occupation for your "self-improvement hours." The hot acid "bite" is by no means fool proof. If the immersions are too prolonged the effect will naturally be more or less detrimental to the steel surface. Different grades of steel contain different amounts of carbon and the character of the steel should be considered before adopting a given time limit for dipping. If hot acid is allowed to act on the steel too long, the surface of the steel will become coated with a film of carbon which in itself will defeat the object of the treatment, or the steel surface will become too rough and render the final finishing operation extremely difficult. To avoid failures, experiment with various temperatures, concentrations, immersion periods, etc., keep a record of each test and when a procedure is adopted, adhere closely to it at all times.

* * * *

Question:—A nickel solution which I prepared during the month of August and which was made from both double and single nickel salts is working very badly. I notice the anodes are covered completely with crystals of nickel salt and the solution is a very clear, deep green color. The nickel plate from this solution is brittle, flakes or scales off when bent. Please let me know how I can put this solution in good condition.

Answer:—Your nickel solution is too dense for the temperature of your plating room. If you do not wish to dilute the solution, remove about one-third of it and heat it to boiling point, then return it to the plating tank and after allowing an hour or so for settling, use the solution. It may be necessary to do this at least twice each week for a short time until the solution becomes less dense by natural operation, or dilute the solution after heating it and dissolving the crystals. Neutralize the excess acid with nickel carbonate. Electrolyze for a few hours with all the current available, using very small cathode, stir thoroughly and you should experience no further trouble unless the temperature becomes very low and density is still too great. Working the solution hard will eventually bring about correct working conditions if you persevere and do not contaminate the solution.

BE TACTFUL

Brute force never wins permanent victories. It may make temporary gains, but its victories are short lived. It requires tactful sympathy to make sure and certain progress. Tact means skill and adroitness in adapting words or actions to circumstances. In other words, to make the words and the actions fit the occasion. Tact requires intellect. Brute force requires physical strength and energy. To show that you are a human being, not merely an animal, be tactful.

THE BRITISH CAST IRON RESEARCH ASSOCIATION APPOINT DIRECTOR OF RESEARCH

The Council of the British Cast Iron Research Association have offered the important position of director of research to the association to Dr. Percy Longmuir, M. B. E., of Sheffield, which he has accepted. He takes up his duties on November 1st.

Dr. Longmuir is one of the foremost recognized experts in cast iron and the appointment is of the greatest importance not only to the ironfounding industry all over the country, but to the engineering and allied trades. His connection with the industry dates from 1897, and his career as foundry apprentice, foreman, manager, and finally as director shows that he has passed through all the necessary practical stages. His metallurgical training was received under Professor Arnold at the Sheffield University, after which in May, 1902, he was awarded a Carnegie Research Scholarship by the Iron and Steel Institute, and this was renewed in 1903, culminating in the receipt of the Carnegie Special Medal for his research on "The Influence of Varying Casting Temperature on the Properties of Alloys," and on "The Properties of Iron and Steel Castings." This research work was followed by a further period of research work at the National Physical Laboratory. The result of this work in collaboration with Sir Robert Hadfield and Professor Carpenter was published in the report of the Alloys Research Committee of the Institution of Mechanical Engineers.

Dr. Percy Longmuir, M.B.E.

Upon leaving the National Physical Laboratory to take up foundry consultant work at Sheffield, Dr. Longmuir was one of the first external examiners in metallurgy appointed for the Sheffield University. From 1909 to 1919 he held the post of works manager at the Stocksbridge works of Messrs. S. Fox & Co., Ltd., and is at present the technical director to Messrs. H. Rossell & Co., Ltd., Sheffield.

Dr. Longmuir has been a very prolific writer of technical papers to various societies, the Iron and Steel Institute proceedings containing no less than ten of his contributions. He was joint author with the late Dr. A. McWilliam of "General Foundry Practice," and also published "Elementary Practical Metallurgy," two well-known standard works.

Dr. Longmuir was one of the founders of the Institution of British Foundrymen and president in 1910 and again in 1911. Apart from his keenness for original research he is intensely interested in the training of the workers and for some years has lectured to large audiences of Sheffield iron and steel workers.

Although the work that lies before the new director is enormous, Dr. Longmuir's great ability and knowledge will, without doubt, be equal to it, and the Council of the Association are to be congratulated upon the appointment which shows the earnestness of their desire to improve the cast iron industry.

NICKEL AND ITS PROCESS

(Continued from page 34)

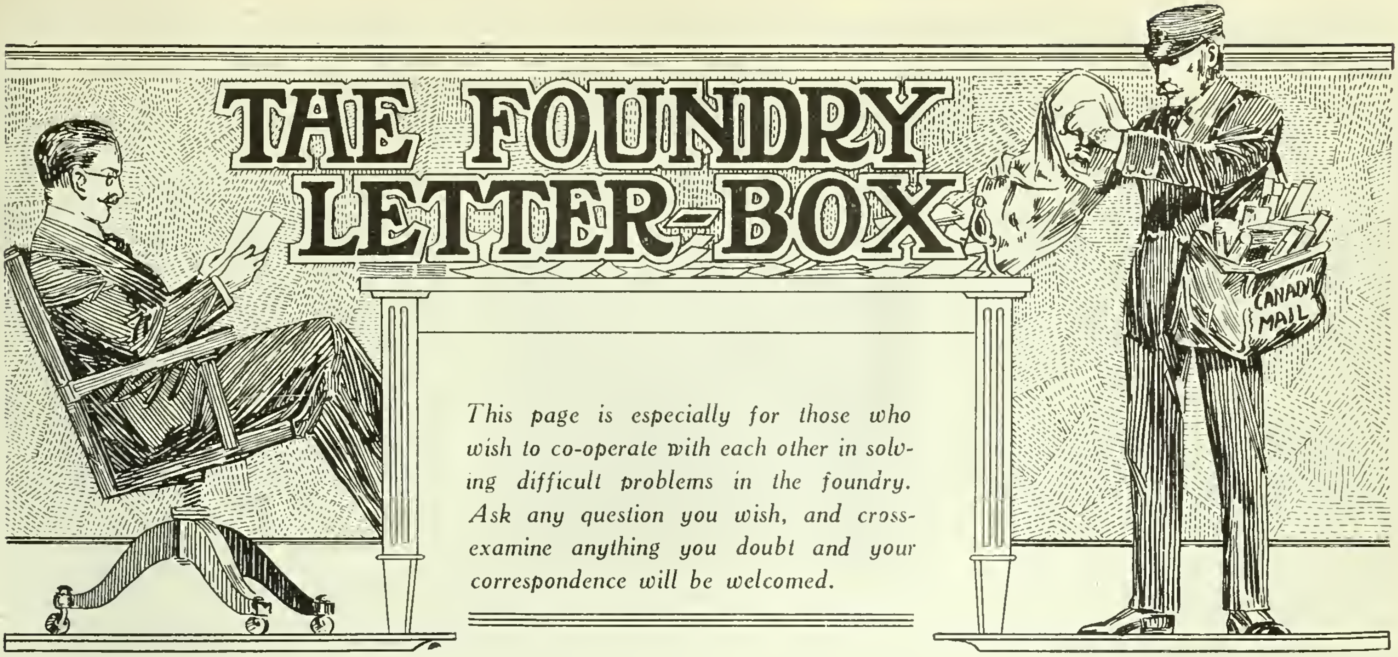
The type of furnace used is the oil fired open hearth.

The charge to be put into the furnace consists of black oxide and charcoal; the amount of charcoal or carbon to be added to the charge depends on the grade of nickel that is to be made.

We are treating three grades of nickel at present, namely: ingot nickel; "A" shot and "X" shot. The ingot nickel is a low-carbon nickel containing about .07 to .10 per cent. carbon and is cast from the furnace into 25 pound and 50 pound ingots. The "X" shot is also low-carbon, but not as low as "ingot" nickel; running about .18 per cent. carbon. This "X" shot is used for the manufacture of alloys such as cupro-nickel; nickel-silver, etc., and in the manufacture of crucible nickel steel.

The "A" shot is high-carbon, running about .5 per cent. carbon, and is used exclusively by the nickel anode makers on account of its easier fusibility. The shot nickel is made by allowing the molten metal to flow from the large swinging spout leading from the furnace into a tank of water, set into the floor, where the nickel granulates into "shot."

Electrolytic nickel is also produced by casting this reduced metal at once into anodes and obtaining pure nickel cathodes from them by electrolysis with an electrolytic of nickel sulphate.



This page is especially for those who wish to co-operate with each other in solving difficult problems in the foundry. Ask any question you wish, and cross-examine anything you doubt and your correspondence will be welcomed.

HAS TROUBLE WITH SAND GIVING WAY BEFORE HOT METAL REACHES IT

Being a constant reader of your very valuable paper, and finding in it cures for many troubles of the foundry, I am writing you about a trouble which I am having.

In making a heavy wheel for Band Mill purposes, with face about 12 in., rim section of about 5 in. in centre and 2½ in. at top and bottom and staggered arms, the rim buckles, I mean by that, the sand bulges into the mold after the metal starts into the mold, and while the sand does not seem to drop off the mold, there is a thin skin of iron behind and it leaves hollow spots in the rim. The casting weighs about three tons, the arms of course being in cores. The hub is split through the centre horizontally with a very thin splitter core and this prevents us from running it on the hub and we therefore run it on the rim through five whirl gates made in cores. The side next the gates is the side giving me the trouble as the rest of the wheel is all right.

For facing the rim, I am using in batch of six wheel-barows,—2 parts local sand, new, 2 parts of a heavy pipe sand, and 2 parts old heap sand with sea-coal 1 to 17.

If you can tell me the cause and a remedy for this default, I shall be greatly obliged.

Answer:—Your mold and the method of gating is such that the entire three tons of melted iron has to pass the one part of the mold on its way through the arms and around the rim. I can understand that the splitting cores in the hub would make it necessary to gate it as you are doing, but this amount of heat beating against a green sand face is more than any ordinary green sand m should be expected to stand. Even though you were intentionally drying the mold you would not subject it to any such a temperature as this. The proper procedure is to mix your facing with a binder the same as you would do in dry sand work, but on a plain fa such as a band wheel there is no better binder required than molasses water. Mix your facing sand with molasses water but otherwise leave the formula as it is. Molasses does not create any disturbance even on light work, but on heavy work the melted metal will bake it hard and hold it firm until the metal gets up to it. The trouble all takes place before the iron comes to it. You will notice the same thing but to better advantage from the standpoint of observaion in a newly lined ladle. Use the ladle once, and then look at it next day and any portion which was not reached by the melted iron will be spalled off while the rest will be all right. The same thing takes place inside of the mold. As soon as the iron covers the sand it melts into a sort of scale, which holds it together, but before this the iron just burns the life out of it and lets it fall away. In the steel foundries the sand is usually mixed with molasses water and baked in an oven. Steel is much harder on the mold than iron, but this will hold it.

INSISTS THAT THERE WAS TEMPERED COPPER

Editor Foundryman: Since writing my article on gearing which appeared in August issue of Canadian Foundryman, I have recalled another gear episode which occurred in Ridgway, Pa., while I was employed there. Lewis' tables on strength of teeth give greater strength to teeth of 20 deg. obliquity, so the chief draftsman adopted that angle. Later on he raised the question of the difference between 5 deg. and 20 deg. obliquity, so I drew a tooth of each angle on the same points so that the difference could be seen. It turned out that he did not know anything about the subject.

On another occasion he had a test piece made of the cast iron used. We asked what it should stand and he said that if he knew the moment of inertia of it he could tell very nearly. Any handbook tells how to get that, but he did not know it. Yet he was a successful draftsman.

Another thing has just come to my mind on a different subject. It is, however, in my estimation, of sufficient interest to be considered. On reading in Canadian Foundryman about old bronze axes I recall your remark about hardening copper, in which you said it was a myth. I do not know that you were aware of the copper chisel that was in Dr. McCallum's collection in Dunnville. It was found on Fradenburg's farm near Cayuga and given to Dan Dashwood who tried it and said it was hard. But in order to determine whether the hardness was in the copper or due to some outside influence he heated it and dressed it as any other cold chisel, after which it proved to be soft. Now there is no reason to doubt Mr. Dashwood's statement about its hardness, and as he is dead and can not be questioned, we must let it pass.

James Bell.

Editor's note:—I did not know about this particular chisel but I have seen several copper chisels of very ancient origin. I never have been privileged to test any of them myself, but I have been informed by the manager of the Royal Ontario Museum that none of the large collection in that institution is any different from ordinary copper, and candidly I cannot conceive how copper can be any different from what it always is without the introduction of some foreign substance to change it, but since I have seen some of the wonders which science has brought out lately I am prepared to believe almost anything.

S. S. MOORE, Managing Editor
F. H. BELL, Editor

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Next Year's Convention in April

AT A MEETING of the directors of the American Foundrymen's Association held in Chicago, on October 3, announcement of which appears elsewhere in this issue, it was decided to hold the next convention and exhibit at Cleveland, Ohio, beginning on April 30 and closing on May 3. It will be remembered that Cleveland was selected last year, but owing to inability to have the building completed in time, and for various other reasons beyond the control of those in charge it was decided to give up the idea of having it there, although realizing that Cleveland was an ideal location. The selection of Cleveland this year will meet with the approval of everyone. The date will seem early on account of former ones being later, but as a matter of fact the convention is being held partly during the first week in May, which does not sound quite so early.

Having it early, has advantages in more ways than one, but one real argument is that people have tired of depression talk and the sooner they wake up to the fact that there is no depression, other than what they make, the better it will be for everyone. Things are practically back to normal already, with the exception of fear on the part of manufacturers that some strike or trouble of some kind may upset things. If we can get past differences of opinion between the men and their employers there is a good year ahead, and by having a good convention and exhibition of foundry equipment, early in the summer, we will be off to an early start for a good season's business.

Platers' Society Has Open Meeting

THE TORONTO branch of the Electroplaters' Society, held an open meeting in their new hall 22 College St. on Monday night, October 23, at which an interesting program of educational importance was carried out.

This society, chartered in 1909, is perhaps, not as well known and understood as it should be. Unlike manufacturers' protective associations or the various trade organizations, it is a strictly educational affair and does not touch on wages or other disputes between employer and employee, but on the contrary it welcomes as a member anyone who is interested in plating and polishing, either as employer or employee.

To the average man who has only an indifferent acquaintance with plating through coming in contact with the finished product there might not seem to be much to know, but if the same man would go to one of these meetings and listen to what is to be heard, he would come away thinking a lot differently. Even the pouring temperature of the metal from which the article is cast comes in for its share of consideration. The leading speaker on the subject of plating was Walter S. Barrows whose able contributions to Canadian Foundryman are now recognized as authoritative by most of the platers and polishers throughout the Dominion of Canada, and to no small extent abroad. The subject which he chose was entitled "From the Anode to the Electro Deposit," and this he handled to the satisfaction of everyone present. His samples of anodes in various stages of extinction were a great aid in bringing his points home. Some anodes showed by their appearance that they had been perfect in their actions, while others showed the reverse. Dr. T. T. Burt Gerrans, Professor of Electro Chemistry at the Toronto University, spoke on the effect of hydrogen on malleable nickel and also enlightened the audience on the possibilities of copper plating aluminum.

An extra attraction was also arranged, which consisted of an address with lantern slides, by C. A. Richardson of the International Nickel Co., on the subject of "Nickel and its Process From the Mine to the Anode." Mr. Richardson's address and some of the views appear in another section of this publication and should be read by every patriotic Canadian since nearly all of the nickel which is used in the world is produced in Canada.

While on the subject of nickel and nickel plating, we might say that Canadian Foundryman is the only publication in Canada which treats on "Plating and Polishing," and this subject is given considerable space in each issue, chiefly in answering questions which are asked by platers who are in difficulty. Features of the subject are also published from time to time apart from the questions and answers. Electroplating is a deeper study than might be considered, but Canadian Foundryman will keep its readers posted on the most approved methods of plating and polishing practice.

Market Conditions and Tendencies

Conditions in the foundry business are very little changed since a month ago, but everything looks encouraging. Things have not yet begun to move as we could wish, but everything points in the right direction. Some lines of work are running normally already, but those manufacturing lines of equipment are not yet making much headway, since most concerns are chiefly interested in using their present equipment to its limit before investing in anything new. The railway companies, are, however, finding it necessary to scrap a lot of their rolling stock in the very near future and replace it with new. Things have begun to move to some extent in the United States, but not a great deal more so than in Canada. They led the way at the beginning of the depression and are due to lead in its extinction, but so far inquiries are the chief movements that are being made. These inquiries are, however, genuine and will soon lead up to good business, as the railroads of the United States are, even now, unable to handle the freight, and the farmers are complaining about the slow movement of grain.

The Chicago, Milwaukee and St. Paul, wants six thousand coal cars, three thousand five hundred box cars, one thousand automobile cars and one hundred locomotives. These orders will be let as soon as the tenders are considered, and the amount of money required for their fulfillment will approximate forty-five million dollars.

The Atchison Topeka and Sante Fe has already spent twenty-three million dollars on improvements this year and will spend twelve million more before the end of the year. Their programme for 1923 calls for an expenditure of forty million dollars.

The Baldwin Locomotive works at Philadelphia, have fifty million dollars' worth of unfilled orders on their books at the present time and this will keep their plant running until April, 1923, when there will be abundance of work coming in. Most of the American roads which can get their men to work are doing a lot of new work in their repair shops, but this does not count for much.

The coal and grain movement is the immediate cause of the present stir, particularly as the close of navigation draws near, but it is not the intention to relax in the least when these temporary rushes are over, as everything has been neglected for so long a time that it will be necessary to make up all neglected improvements.

Canada cannot lag behind, as our roads are as much in need of new equipment as are those of our neighbors. Our locomotive and car shops are already beginning to bestir themselves preparatory to the anticipated business, but owing to the change in ownership and management in our National lines this has necessarily been delayed. Railway work means a lot to the foundries of the country and as soon as the railroad shops get rightly under way they will need new installations which will be required for their own use.

The unsettled state of the markets stands in the way of normal business, since no one wants to buy in a declining market. The coal strike and the consequent shortage of coal upset the production of pig iron on this continent to such an extent that outside producers had a profitable field both in Canada and the United States. It is estimated that over 6,000 tons of pig iron were discharged at the port of Montreal from British vessels during the first week in Nov., and reports are that even larger quantities will arrive by succeeding steamers before the close of navigation. A great deal of this iron is finding its way inland, a large portion being for Ontario points. It is not expected, however, that Scotch iron such as Summerlee and Carron will find a permanent place in the Ontario market, and unless something unforeseen happens Canadian iron will again be exclusively used there. There is a good deal of Middlesborough pig iron going into Ontario, but it is not as good as Scotch foundry iron and is merely for mixing purposes.

Discussing the pig iron situation a large dealer states:

"With regard to the pig iron situation, there has, of course, been a considerable quantity of English and Scotch imported during the past few months, and we have sold a fair quantity for Ontario delivery. This is, of, course, special business arising out of the situation in connection with the coal strike and we could not look for its continuation except perhaps in isolated cases. The situation locally is naturally improving and prices we judge, are very close to the cost of import to-day. We can lay down Scotch pig iron to-day at most Ontario towns at about $36.00 per ton delivered, duty paid. this, of course, being for direct import and not from stock. We consider that, by the Spring, conditions will have become quite normal and that it will be difficult or impossible to sell imported pig iron, except at points such as Montreal or nearby places where the import freight rate is very low. British furnaces have, of course, sold a large quantity for export to the U. S. during the past few months, and prices are naturally stiffer as a result. We therefore do not look for any easier prices on the other side at present."

Canadian furnaces which were up against an unpleasant situation on account of the coal shortage are already beginning to get in shape to regain their lost business. The Canadian Furnace Company, Port Colborne, Ont., rather than attempt to run under such conditions as prevailed during the summer, blew out their furnace and are making extensive alterations and improvements, and are expected to be ready for business shortly. The Steel Company of Canada have been entirely rebuilding their furnaces at the Hamilton, Ont. plant and will blow in the second furnace in a few days, on foundry pig iron. The other furnace companies are all getting ready for good buisness after the first of the new year.

While it is quite easy to get selling price quotations on new material of all kinds and sometimes on scrap iron it is a difficult matter to get quotations on non-ferrous scrap, other than what the dealer is prepared to pay. The selling price will be this, plus his profit which will depend on the amount of the purchase and the terms of payment, etc. Present selling prices of pig iron on siding at place of unloading are as follows:

No. 1 Canadian pig, Toronto	$33.80
Algoma, No. 1, Montreal	38.65
Summerlee, Montreal	35.00
Grey Forge, Pittsburgh	31.25
Lake Superior Charcoal Chicago	36.15
Standard Low Phos., Phila.	38.00
Bessemer, Pittsburgh	34.77
Basic, Valley Furnace	30.00

Selling Price of New Non-Ferrous Metals

Lake copper	$17.50
Electrolytic copper	17.25
Casting copper	17.00
Tin	40.00
Lead	7.50
Zinc	9.50
Antimony	7.50
Aluminum	22.00

For scrap iron the dealers are paying the following prices:

No. 1 machinery scrap iron	$18.00
Stove plate	16.00
Malleable	10.00
Cast borings	4.00
Heavy melting steel	10.00

Non-Ferrous Scrap Metals

Copper, light, per 100 lbs.	9.00
Copper, crucible	11.50
Copper, heavy	11.25
Copper wire	11.25
No. 1 composition	9.00
New brass cuttings	6.00
Red-brass turnings	6.50
Yellow-brass turnings	5.25
Light brass	4.50
Medium brass	6.00
Scrap zinc	3.50
Heavy lead	4.50
Tea lead	3.00
Aluminum	11.00

The National Bronze Company, Limited, is a new organization recently chartered with a capitalization of $50,000, by Henry J. Chanvin, John J. Meagher, and Harold E. Walker, Montreal, Que. They will construct and operate a brass and bronze foundry in that city.

* * * *

New Industry for Welland. The Dodds Canadian Iron Works, Limited, is the name of a new concern which has been organized at Welland, Ont., with a capital of $200,000. They will operate a foundry and machine shop and will manufacture flour mill and similar machinery.

* * * *

The Vulcan Iron Works, Winnipeg, Man., have been making additions to their foundry equipment, among which is an electric travelling crane of five-ton capacity, supplied by the Northern Crane Works, Walkerville, Ont. This crane is of the latest type, with two electric motors.

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Hugh Park Foundry, Limited, Oshawa, Ont., manufacturers of the Beardsley-Piper sand throwing machine for the Canadian trade, are building one machine of the portable type for Goldie and McCulloch of Galt, Ont. This machine throws the sand instead of shovelling it into the mold and ramming it, and will handle miscellaneous work of the largest size.

* * * *

The Industrial Digest, 25 West 45th St, New York, celebrated their first birthday on Oct. 2. This publication, as its name implies, makes it its business to reproduce a synopsis of the leading articles in the industrial publications of the world as well as all industrial doings. That it has been a success goes without saying. The amount of information which it gives is such that would occupy all of a business man's time culling from the different papers if he had to do it himself. By placing the titles and leading points in a manner where the busy man can see what will interest him, he knows where to locate any knowledge he may require. The Industrial Digest begins its second year with best wishes from Canadian Foundryman.

The Ajo Copper Mines of Arizona, which are among the important mines of the country, were begun in an arid desert, but the water which has continually, to be pumped from the mine has now made the neighborhood as green as though it had never been a desert, while all around is the same desolate hot sand of the desert, with this beautiful oasis in its midst.

* * * *

Manganese and Steel Foundry, Limited, is a new concern which has just recently began operations at Sherbrooke, Que. Their premises are situated on Water Street, and they have already begun to execute a number of orders for their product. The company have one furnace of one ton capacity, capable of running three heats per day, but it is the intention to greatly increase this equipment and capacity in the near future. Mr. P. McCullough, formerly of the Canadian Brakeshoe Company is the president and general manager, while Mr. A. S. Bayles, formerly of the Canadian Ingersoll-Rand Company, is secretary-treasurer.

* * * *

Dominion Insulator & Manufacturing Co., Ltd., which is a division of the Ohio Brass Company, Mansfield, Ohio, announces that it is now constructing a factory at Niagara Falls, Ont., for the manufacture of the most up-to-date, approved design of high tension porcelain insulators and other "Ohio-Brass" products, such as trolley materials, and rail bonds for electric railways and mines, electric car equipment and steam road electrification materials. The new plant will be of the latest construction and will be equipped with every modern facility for the production of this class of material by the most advanced processes. It is the intention to have the factory in production order before the end of the present year.

* * * *

"The improper use of explosives, caused 31 deaths and 73 injuries during 1920," remarked Lieut.-Col. G. Ogilvie, chief inspector of explosives, Ottawa, during an account of the operation of the Explosives Act of Canada, at a joint meeting of the Montreal Branch of the Engineering Institute of Canada, the Montreal section of the Society of Chemical Industry and the Canadian Institute of Mining and Metallurgy. Sheer negligence, he said, was the cause of many accidents and recklessness contributed its share. "It is very fortunate for us," continued Col. Ogilvie, "that the supply of explosives, other than fireworks, is practically all from Canadian factories. Not only does this facilitate the authorization of the explosives put on the market, but, enjoying as we do the co-operation of manufacturers, we have benefited by their influence over their customers in matters relating to the keeping of explosives."

* * * *

Elliot Machinery Co., Belleville, Ont., are distributing a neat catalogue of their woodworking machinery which consists essentially of an universal machine which can be converted into almost any machine required in woodworking. The illustrations show the machine set up for cross-cutting, housing stair-stringers, ripping, scroll-sawing, jointing, dadoing, etc. Other machines illustrated and described are scroll saws and sand-papering machines. All the machines described are such as would be used outside of regular woodworking plants. They are driven by electric motor which accompanies the machine. Contractors working on buildings can do a lot of their own machine work. Foundries could use them to good advantage in flash work and pattern making. The catalogue tells the whole story and is to be had for the asking.

'LECTROMELT CALCULATOR

The Pittsburgh Electric Furnace Corporation have just developed a handy calculator made of celluloid for figuring the amount of ferro-alloy required for different alloys and various metal mixtures to allow any given percentage of alloy, and allow any ordinary percentage of loss in the absorption of an alloy. This device is intended for the aid of the furnace superintendent and melter in the foundry and metallurgical industry generally, and on account of the rapidity and accuracy with which the calculations are made, will serve a very useful purpose throughout the steel and metal field. The device is of circular form, 7 inches in diameter and made in three pieces pivoted in the centre. Six graduated scales provide for the direct reading of the various elements used in the calculations. The price of this device is $5.00.

BOOKS, CATALOGUES

Elements of Industrial Heat Treating is a 44-page book, profusely illustrated, and treating on the subject referred to in its title. The purpose of the book, as outlined on the second page is to encourage a broader view of the principles governing the heat-treatment of metallurgical, chemical and ceramic products, and the selection and use of equipment, fuel or electricity as a means to that end. The matter is all technical and relates to principles and their application in practice and has been reviewed by teachers and engineers of note to insure its accuracy and freedom from bias before publication. Some of the subjects which should be particularly attractive to those interested are: "Relation of temperature control to uniformly heated product;" "Factors affecting time and method of heating and cooling;" "Relation and price of fuel to cost of production;" "Factors governing the selection of fuel or electricity." The book is published by W. S. Rockwell Company, furnace engineers and contractors, 50 Church Street, New York, and is free for the asking.

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Belt Conveyors and Belt Elevators, by Frederic V. Hetzel, is a book which, as its name implies, treats on a subject which is of vital interest to foundrymen, and one which has received considerable attention in Canadian Foundryman—that of handling material by belt conveyor. This book was written especially for:

1—Men who have material to handle and who want to know more of the "how" and "why" of conveying and elevating machinery than can be told in the catalogues and advertisements of manufacturers.

2—Consulting engineers who have to advise in the selection of the proper machinery to do certain work.

3—Engineers and draftsmen who design conveying and elevating machinery.

4—Students in technical schools and colleges.

The author's treatment of the subject is clear, thorough and practical, explaining principles and the reasons for doing things, as the result of 30 years' experience at the drafting board, in the shop, and in the field supervising the erection and operation of conveying and elevating machinery.

While the machines described do not cover the whole field of handling materials, they are so generally useful and suit so many kinds of material under so many operating conditions, that they are used to illustrate some of the general principles underlying the design and use of conveying and elevating machinery.

As chief engineer of one of the largest companies in the business, extending over a period of 13 years, Mr. Hetzel was responsible for the design of all kinds of conveying and elevating machinery, and acquired valuable experience in dealing directly with suggestions and complaints from users of the machinery, and in co-operating with them in effecting improvements in design and manufacture.

Much of the information published in this book has never before appeared in print.

The book is published by John Wiley & Sons, 432 Fourth Avenue, New York, Chapman & Hall, London, Eng., and Renouf Publishing Company, Montreal. It has 333 pages, 6 by 9 inches, and contains 291 illustrations. The binding is cloth. Price $5 postpaid (25s. net).

* * * *

Burning Liquid Fuel is the title of a three hundred and forty page book, by William Newton Best, and published by U. P. C. Book Company, Inc., 243-249 West 39th Street, New York. It is a practical treatise on the perfect combustion of oils and tars, giving analyses, caloric values, and heating temperatures of various gravities with information on the design and proper installation of equipment for all classes of service. The first one hundred and fifty pages are of exceptional interest to those engaged in engineering pursuits, while the remaining pages are of particular interest to the foundrymen. In the chapter on "Steel Foundry Practice," 18 illustrations, mostly full page drawings, are shown, along with detailed descriptions of the various methods of producing best results with oil fuel in the steel foundry. The chapter on "Heat-treating Furnace Practice," is treated in an equally thorough manner, and illustrated with 21 engravings. Malleable iron, gray iron and brass foundry practice, are all covered thoroughly, showing the various types of oil burners, reverberatory and crucible furnaces. Copper industry, forge work, boiler making, enameling, chemical, brick and lime kiln, cement, ore roasting, road work, baking, chocolate and candy making, sugar, glass, etc , are all treated. In the engineering sections, which include stationary, marine and locomotive boilers, with apparatus for firing with liquid fuel, nothing seems to be omitted. The book is 6 x 9 inches, bound in cloth. Price $4.00.

* * * *

Safe Foundry Practice is the title of a seventy-page book 6 x 9 inches, published by the Travelers' Insurance Company, Hartford, Connecticut. The contents of the book, in no way refer to insurance, but this can, of course, be implied. The object of an insurance company publishing a book of this kind would be to educate the workmen in the foundry as well as those who employ them, so that the hazards of the work may be lessened, thereby making the risk from an insurance standpoint less hazardous. From this point of view it is an invaluable book to possess, since it covers practically every phase of foundry work, drawing attention to the danger spots which should be avoided. It is illustrated with eighteen large half-tone engravings, of appliances used in foundry work, and shows the good and bad points in each of them. Stress is placed on keeping the windows clean and the walls and the entire interior white and cheerful looking. Obstacles should not be allowed where men are likely to be walking when carrying melted iron. Many other points of importance are dwelt upon and illustrated. All told it is well worth asking for.

OBITUARY

Readers of Canadian Foundryman will learn with regret of the death of John P. Pero, of the Canadian Steel Foundries Co., Montreal, which took place on Sept. 23th last. Mr. Pero was an American by birth but had spent much of his time in Canada. He was a molder by trade and knew the grey iron and malleable business from A to Z. He was born at Waltham, Mass., Dec. 9, 1856, but moved with his parents to Worcester, Mass., when a child, and there he spent most of his school days, and also served his apprenticeship in the foundry business. Mr. Pero came to Canada in 1905 and settled in Brantford, Ont., where he held the position of manager of the Pratt & Letchworth, malleable works. He remained in Brantford for four years, when he again moved to the United States, but later on returned to Canada where he took a responsible position with the Steel Foundry Co., in Montreal. Mr. Pero was one of the charter members of the American Foundrymen's Association, and always took a prominent part in its activities. He was elected president of the association in 1916, and re-elected for 1917. He was buried at Indian Orchard, Mass., on Sept. 26.

Woodward's Patent Heaters for use in foundries and other manufacturing and engineering plants, are most thoroughly described and illustrated in a neat catalogue being distributed by Woodward Bros., Copelin Limited, Unwin Road, Glengall Road, Peckham, London, S. E. 15, England, who manufacture a full line of these heaters under the name of "Gem heaters." What are referred to in Great Britain as heaters include what Canadians would designate as a blow torch or oil burner. In the list described are compressed air, oil burners for lighting purposes in out-of-the-way places, and with the burner on a swivel so that it can be turned to any angle; heating burners for expanding hubs preparatory for shrinking onto shafts; stands for holding a number of burners at the same time so that flames can be brought to bear upon a large surface simultaneously; burners for lighting coke fire in cupola, for drying ladles for skin-drying molds and numerous purposes in and about the foundry and other departments. Spare parts and details are also shown. The descriptive matter explains everything.

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143 University Ave. Toronto, Ont.

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TWO CENTS A WORD, including the "Canadian Foundryman" box numbers; minimum charge is $1.00 per insertion, for 50 words or less, set in 6 point type. Each figure counts as a word. Display ads., or ads. set in border, are at card rates.

POSITION WANTED

BRASS FINISHER, GOOD ALL ROUND MAN, lathe and bench hand, plain pattern making, good knowledge of polishing and plating. At liberty July. Go anywhere. Box 704 Canadian Foundryman.

PRACTICAL FOUNDRYMAN, 25 YEARS ON light, medium, and heavy work, green and dry sand. Bench, floor and machine molding. Melt by analysis and thoroughly competent on Cupola practice. Good reference. Box 707, Canadian Foundryman. (C.3F.)

WANTED

WANTED—A TABOR MOLDING MACHINE squeezer No. 10—34" between upright, to be in A1 condition. State price. Apply W. J. Dalgleish, 221 Dundas St., Galt, Ont.

POSITION WANTED BY FOUNDRY Foreman, 25 years practical experience on Stove, Furnace, Boiler Sections, Match Plates, and Moulding Machines. Capable of figuring costs. McLain graduate, presently employed but desires change. Address Box 706 Canadian Foundryman.

NOW!

You've been going to send in that ad for weeks, so why not mail it now for next month's issue?

CANADIAN FOUNDRYMAN

143 University Ave. - TORONTO

PATENT NOTICE.

TO ALL WHOM IT MAY CONCERN:

Be it known that CHARLES PRACHE, of Paris, France, is willing to license any Canadian manufacturers under his Canadian Patent No. 203,025, for EVAPORATOR.

Further information may be had by applying direct to me, or to Messrs. Marion & Marion, 364, University Street, Montreal.

MODERN EQUIPPED FOUNDRY FOR RENT

A WELL-KNOWN MANUFACTURING plant will rent their UP-TO-DATE foundry to responsible party. **They will also take large proportion of output.**

Floor space of main foundry is 140 feet by 60 feet, and all modern equipment is included. Following are some of the UP-TO-DATE facilities:

LARGE CUPOLA, ELECTRIC OVERHEAD CRANE, CONTINUOUS ELEVATED TRACK, METAL POURING CRANE, SAND BLAST, TUMBLING BARRELS, PATTERN SHOP, COMPRESSED AIR LINES, CORE OVENS, RAILWAY SIDING.

This is the chance of a lifetime. None but responsible parties need apply. Rent reasonable and prospects particularly bright. For further particulars write, Box No. 709,

CANADIAN FOUNDRYMAN

CLOSING TIME

Advertisements for this section must be in our hands on the 9th of each month.

In order that the announcements of your wants, etc., shall not be delayed, please try to have them in our office as early as possible.

CANADIAN FOUNDRYMAN

FOR SALE

BARGAIN IN USED ELECTRIC FURNACE—A one-ton Volta Electric Furnace for melting steel, grey iron or Ferro alloy furnace, 220 volts, 25 cycle, 3 phase; complete equipment. For further particulars write Hiram Walker & Sons. Metal Products, Limited, Walkerville, Ont., P.O Box 156. (c.t.f.f.)

FOR SALE—ONE SAND-MIXING MACHINE—Double-Cage type, ball bearings in oil bath throughout, gears of case-hardened steel. A bargain for someone. Box 710, Canadian Foundryman. (C.F.F.)

TAYLOR SAFES FOR SALE RARE OPPORtunity to secure a safe at small cost. They are in splendid condition. Inside dimensions and prices are as follows: 15" deep, 2 ft. 6" wide, 3 ft. 11½" high, fitted with built-in compartment. Price $250.00. 18" deep, 2 ft. 8" wide, 4 ft. 5" high, fitted with steel compartment. Price $200.00. Apply Box No. 711. (CFF)

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Manufacturers and Importers of High Grade Fire Brick, Fire Clay and General Supplies. Special Shapes, Cupola Block, Stoker Brick, Boiler Tiles, Stove and Quebec Heater Linings.

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Steel Ladles, Shanks, Flask Bands, Tote Boxes, Shop Barrels, Heavy Plate Tanks, Oily Waste Cans, Air Receivers, Smoke Stacks. Write For New Catalogue

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Ask Your Bank Manager—

if you would find the Financial Post of real benefit to you

He will tell you that THE FINANCIAL POST is Canada's leading financial and investment newspaper; that it will solve your investment problems, save you from loss and analyze business conditions for you.

He probably reads and enjoys THE POST —2,200 Canadian bank men do—and will tell you how THE POST can help you. Or if you want to subscribe now to this valuable weekly newspaper of news and views of business and investment send $5 to-day.

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CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Directory of Foundry Supply Houses

The Buyers' Directory of Canadian Foundryman was originally intended to contain information regarding lines in the production of which the advertisers actually specialized. We now carry the advertising of leading supply houses, some of whom represent scores of manufacturers, in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the supply houses so we recommend that for all general requirements our subscribers communicate with the supply houses listed below:

The Hamilton Facing Mill Co., Limited, Hamilton, Ont.

Frederic B. Stevens, Windsor, Ont.

The E. J. Woodison Company, Limited, Toronto, Ontario; Montreal, Que.

ANODES, BRASS, COPPER, NICKEL AND ZINC
W. W. Wells, Toronto, Ont.

ARGON
Dominion Oxygen Co., Toronto, Ont.

BRASS FURNACES
Hawley Down Shaft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.

CHEMISTS
Charles C. Kawin, Chicago, Ill.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Indiana

CORE MACHINES
American Foundry Equipment Co., New York City.

CORE OVENS
Damp Bros., Mfg. Co., Toronto, Ontario.
Monarch Engineering Mfg. Co., Baltimore, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.

CORE PLATES
Damp Bros., Mfg. Co., Toronto, Ont.

CORE SAND
Benson & Patterson, Stamford, Ont.
George F. Pettinos, Philadelphia, Pa.

CRANES
Northern Crane Works, Ltd., Walkerville, Ont.

CRUCIBLES
Joseph Dixon Crucible Co., Jersey City, N. Y.
J. H. Gautier & Co. Jersey City, N. Y.

CUPOLAS
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Monarch Engineering & Mfg. Co., Baltimore, Md.

CUPOLA LININGS
Whitehead Bros., Buffalo N. Y.

DUST ARRESTERS
W. W. Sly Mfg. Co., Cleveland, Ohio.

EDUCATIONALISTS
McLain's System Inc., Milwaukee, Wis.

ELECTRIC RIDDLES
Great Western Mfg. Co., Leavenworth, Kansas.
Preston Woodworking Co., Preston, Ont.

FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FIRE BRICK
Bailey & Bell Firebrick Co., Toronto, Ont.

FLASKS, SNAP
American Foundry Equipment Co., New York City.

FLASKS, STEEL
American Foundry Equipment Co., New York City.

FLUXES, IRON, BRASS, ALUMINUM, COPPER
Basic Mineral Co., Pittsburgh, Pa.

GRIT AND SHOT, SAND-BLAST
Pangborn Corp. Hagerstown, Md.

LADLES
Damp Bros., Mfg. Co., Toronto, Ont.

LADLE SHANKS
Damp Bros., Mfg. Co., Toronto, Ont.

MAGNETS
Dings Magnetic Separator Co., Milwaukee, Wis.

FLUOR SPAR
Basic Mineral Co., Pittsburgh, Pa.

FOUNDRY ENGINEERS
Austen Company, Cleveland, Ohio.
Charles C. Kawin, Chicago, Ill.
H. M. Lane Co., Detroit, Mich.
McLain's System Inc., Milwaukee, Wis.

FURNACES, OIL
Hawley Down Draft Furnace, Easton, Pa.
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES, GAS
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES COKE
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES ELECTRIC
Pittsburgh Electric Furnace Corp., Pittsburgh, Pa.
Electric Furnace Co., Salem, Ohio.

GRINDERS, PORTABLE
A. W. Sainsbury, Ltd.
Cleveland Pneumatic Tool Co., Toronto, Ont.

GRINDERS, SWINGING
A. W. Sainsbury Ltd., Sheffield, Eng.

GRIT AND SHOT, SANDBLAST
Globe Iron Crush and Shot Co., Mansfield, Ohio.

HEATERS
E. J. Woodison & Co., Toronto,

HOSE COUPLINGS
Cleveland Pneumatic Tool Co., Toronto, Ont.

INDUSTRIAL ENGINEERS
H. M. Lane Co., Detroit, Mich.

IRON CEMENT
Smooth-On Mfg. Co., Jersey City, N.J.

KAOLIN
Whitehead Bros., Buffalo N. Y.

MAGNETIC SEPARATORS
Dings Magnetic Separator Co., Milwaukee, Wis.

METALLURGISTS
McLain's System Inc., Milwaukee, Wis.
Charles C. Kawin, Chicago, Ill.

METAL PATTERNS
Bryant Pattern Works, Windsor, Ont.
Hamilton Pattern Wks., Toronto, Ont.

MOLDING MACHINES
American Foundry Equipment Co., New York City.
Herman Pneumatic Tool Co., Pittsburgh, Pa.
Tabor Mfg. Co., Philadelphia, Pa.

MOLDING SANDS
Whitehead Bros., Buffalo N. Y.
Benson & Patterson, Stamford, Ont.
Geo. F. Pettinos, Philadelphia, Pa.
Venango Sand Co., Franklyn, Pa.

OXYGEN
Dominion Oxygen Co., Toronto, Ont.

PATTERN MAKERS
Bryant Pattern Works, Windsor, Ont.
Hamilton Pattern Wks, Toronto, Ont.

PIG IRON
A. C. Leslie & Co., Ltd., Montreal.
Steel Co., of Canada, Hamilton, Ont.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto, Ont.

PULLEYS
Dings Magnetic Separator Co., Milwaukee, Wis.

RIDDLES
Great Western Mfg. Co., Leavenworth, Kansas.
The Preston Woodworking Machine Co., Preston, Ont.

SAND
Benson & Patterson, Stamford, Ont.
George F. Pettinos, Philadelphia, Pa.
Venango Sand Co., Franklyn, Pa.
Whitehead Bros., Buffalo N. Y.

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American Foundry Equipment Co., New York City.
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SAND MIXERS
Philips & McLaren Co., Pittsburgh, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
National Engineering Co., Chicago, Ill

SAND SIFTERS
Great Western Mfg. Co., Leavenworth, Kansas.
Monarch Engineering & Mfg. Co., Baltimore, Md.
National Engineering Co., Chicago.
The Preston Woodworking Machine Co., Preston, Ont.

SAND BLAST HELMETS
Pulmosan Safety Equip. Co. Brooklyn.

SAND BLAST MACHINERY
American Foundry Equipment Co., New York City.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.

SAND MULLERS
National Engineering Co., Chicago, Ill

SAND BLAST ABRASIVES
George F. Pettinos, Philadelphia, Pa
Globe Iron-Crush & Shot Company, Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND RAMMERS
Cleveland Pneumatic Tool Co., Toronto Ont.

SHOT AND GRIT, SAND-BLAST
Pangborn Corp Hagerstown, Md.
Globe Iron Crush and Shot Co., Mansfield, Ohio.

SNAP FLASKS
American Foundry Equipment Co. New York City.
Damp Bros., Mfg Co., Toronto, Ont
Diamond Clamp & Flask Co., Richmond, Indiana.

SNAP FLASK JACKETS
Damp Bros., Mfg. Co., Toronto, Ont.

STEEL BANDS
Damp Bros., Mfg. Co., Toronto, Ont.

TUMBLING BARRELS
R. MacDougall Co., Galt, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio

VALVES
Cleveland Pneumatic Tool Co., Toronto, Ont.

WELDING AND CUTTING SUPPLIES
Dominion Oxygen Co., Toronto, Ont.

Patterns!

Phone Adelaide 5439

Put your pattern problems in our hands. Quality work and prompt service assured. Patterns made for all foundry purposes—wood and metal, models and aluminum plate work.

The A. J. HAMILTON PATTERN WORKS

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Metal Workers' *CRAYONS*

Sawed from purest Talc; medium hard, guaranteed free from grit. Equal to best imported product but lower in price.

Send for free sample.

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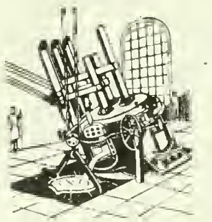
STANDARD THE WORLD OVER

PANGBORN CORPORATION HAGERSTOWN, MD.
SAND-BLAST SPECIALISTS

P. O. BOX 8508

MOORE RAPID 'LECTROMELT

STEEL FURNACES



The mechanical design of the Moore 'Lectromelt Furnace makes for simple, practical ease and rapidity of operation. A higher yield of good solid ingots and castings is insured on account of the absence of cold shorts, hot cracks, blow holes and surface defects. The regularity of the heats and rapidity of operation—speed up production and reduce foundry costs.

PITTSBURGH ELECTRIC FURNACE CORP.

(Makers of Furnaces for Steel, Iron, Brass, and Ferro-Alloys)

PITTSBURGH, U. S. A.

ANGULAR GRIT

SCIENTIFIC METALLIC BLASTING ABRASIVE

Trade Mark

Adopt metallic abrasive instead of sand. Angular Grit will reduce your costs — one hundred pounds of grit will outlast five tons of sand. It cleans faster, requires less handling and less storage space, and reduces dust 80%. Write for samples.

Pittsburgh Crushed Steel Co. Sole Manufacturers

PITTSBURGH, Pa., U.S.A., Established 1888

Canadian Representatives: WILLIAMS & WILSON Ltd., Montreal, Canada

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AMERICAN

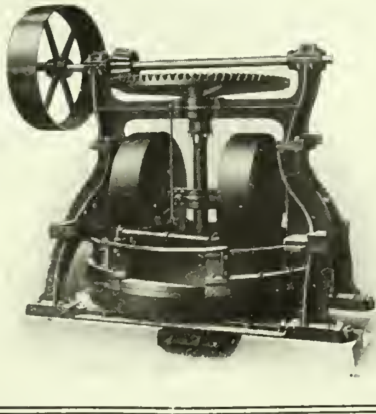
Molding Machines	A EQUIPMENT	Pattern Compound
Charging Buckets		Core Machines
Dust Arresters		Oven Trucks
Sand Cutters		Steel Flasks
Snap Flasks		Sand Blast

AMERICAN FOUNDRY EQUIPMENT COMPANY

366 Madison Ave., New York City

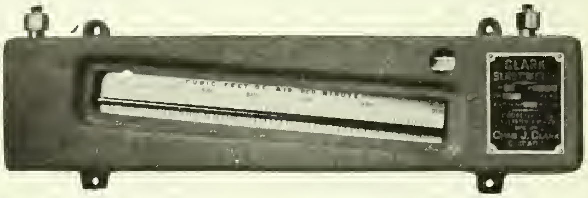
PHILLIPS & McLAREN CO.

Sand Mixers-Grinding Pans



of all types and sizes for mill and foundry use. Also Jaw Crushers.

24th and Smallman Sts. Pittsburgh, Pa.



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indicates the number of cubic feet of air or gas passing per minute.

The Meter is furnished in any capacity desired, each one built to order and guaranteed in every respect. Several hundred are in use in smelters, steel works, coke plants, etc.

Booklet cheerfully sent—write for it.

CHAS. J. CLARK BLAST METER CO.

Gladbrook, Iowa.

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HARDLY a week passes that Canadian Foundryman does not receive copies of this paper returned by the postal authorities because of the change in firm names or the address of some whose names are on the mailing list. Sometimes complaints reach us of the non-delivery of mail matter. It is not till the receipt of such complaints or the return of the paper, as the case may be, that we obtain any knowledge of the changes or removals of persons or firms. The adoption of the co-operative spirit on your part by notifying changes would make things a good deal more pleasant for both parties. The MacLean Publishing Co. want their mailing list to be in such shape that they will be able to render the perfect service to their subscribers. There is a lot of valuable trade matter mailed by this company and if you don't receive it — well, the fault is entirely yours.

INDEX TO ADVERTISERS

To keep an even balance with the particular, on the one hand and the peculiar, on the other, is something of an art; Stevens' Plumbago (direct from India) is doing just that.

It is suiting the most fastidious.

When you question that, in the least, send for a free working sample and prove my assertion. State the class of molds, whether for cylinders, for flat or raised and indented surfaces like ornamental Stove Plate and your prescription will be filled.

My warehouses are filled with good stocks of Foundry Equipment and Supplies; Electro-Plating Equipment and Supplies for I not only manufacture Foundry Facings, but, also Buffing Compositions and Brass Foundry Supplies.

Canadian shipments made from warehouse at Windsor, Ontario, thus avoiding all bother to the buyer from Custom House details.

STEVENS' STAMPED STEEL LADLES

All sizes in warehouse stock, from 60 lbs. to 250 lbs. capacity, each ladle is stamped from a single piece of steel.

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Manufacturer of Foundry, Electro-Plating and Polishing Supplies and Equipment

Cupola Blocks, Fire Brick and Clay

Corner of Third and Larned Streets
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EDITORIAL INDEX—Page 17. BUYERS' GUIDE—Page 45 ADVERTISING INDEX—Page 48.

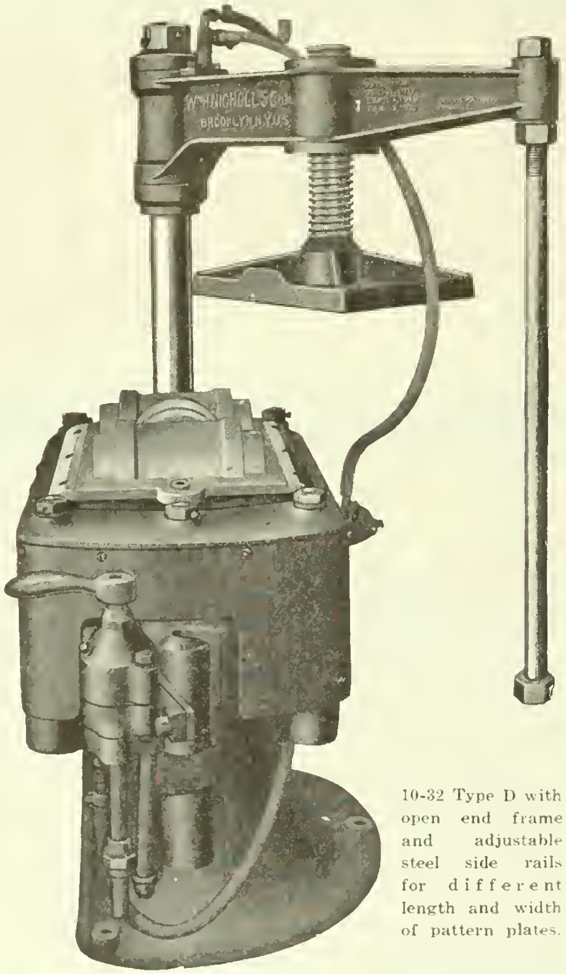
CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

A Monthly Newspaper Devoted to the Foundry, Patternmaking, Plating and Polishing Fields. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, and London, England.

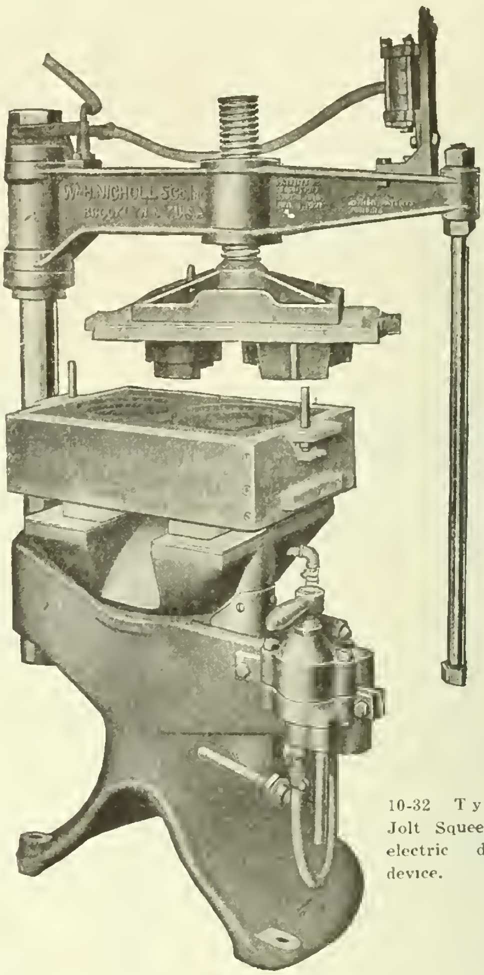
Vol. XIII Publication Office, Toronto, December, 1922 No. 12

NICHOLLS

MOLDING MACHINES



10-32 Type D with open end frame and adjustable steel side rails for different length and width of pattern plates.



10-32 Type E Jolt Squeeze and electric drawing device.

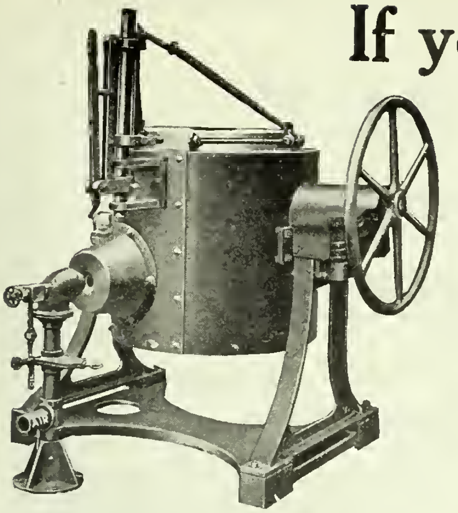
Better Machines—and Why!

These molding machines have no gears, toggles, cams, springs, canvass guards, small leaky valves, balance springs or complicated parts or adjustments, they are easiest on the operator and quickest to operate and most economical on air consumption. They have the least number of working parts; have a substantial base and an absolutely positive jolt without rebound. The heads swing in and out horizontally with the slightest effort; they are equipped with ball bearings top and bottom.

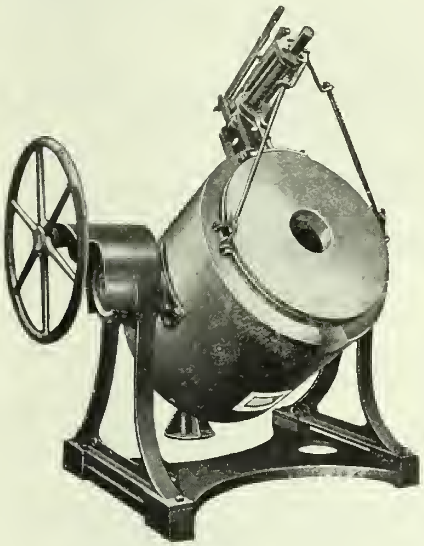
These machines contain many more features—write for full description.

WM. H. NICHOLLS CO., INC.

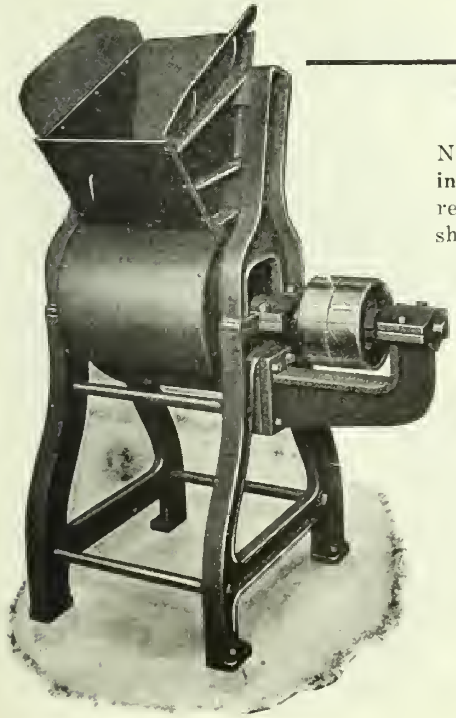
8-10 College Place — Brooklyn, N. Y.



Monarch Tilting Crucible Furnace, Combustion Chamber Oil or Gas.



Monarch Steele-Harvey Crucible Tilting Furnace, Oil or Gas, Coal or Coke.



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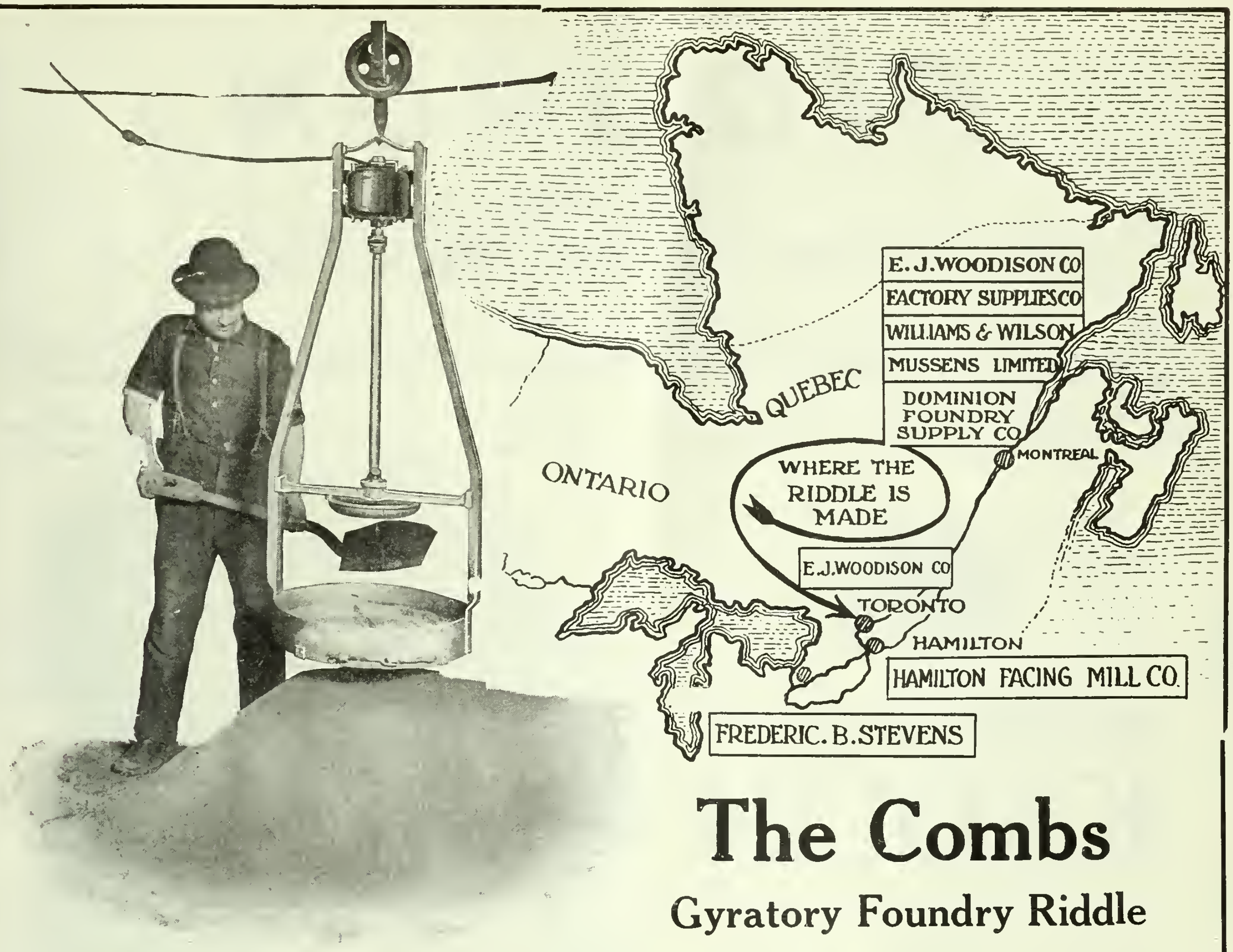

The Combs

Gyratory Foundry Riddle

Just what would it save in your shop?

You'll agree that the time of your employees is the most costly item of your manufacturing costs and that a liberal percentage of this goes for time spent in screening sand.

With a COMBS GYRATORY RIDDLE sifting sand as fast as one man can shovel it in—doing it faster, and better, than ten men can by hand—your costs are going to drop, as they have dropped wherever the Combs is installed.

Let us tell you about our Unique Thirty Days' Trial

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E. J. Woodison Co., Toronto.
Hamilton Facing Mill Co., Hamilton.
Frederic B. Stevens, Windsor, Ont.

QUEBEC AGENTS:

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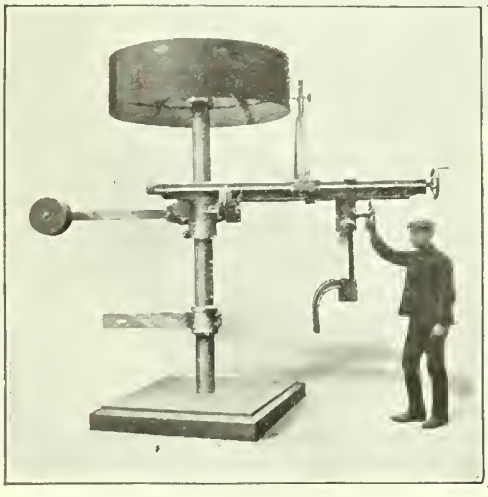
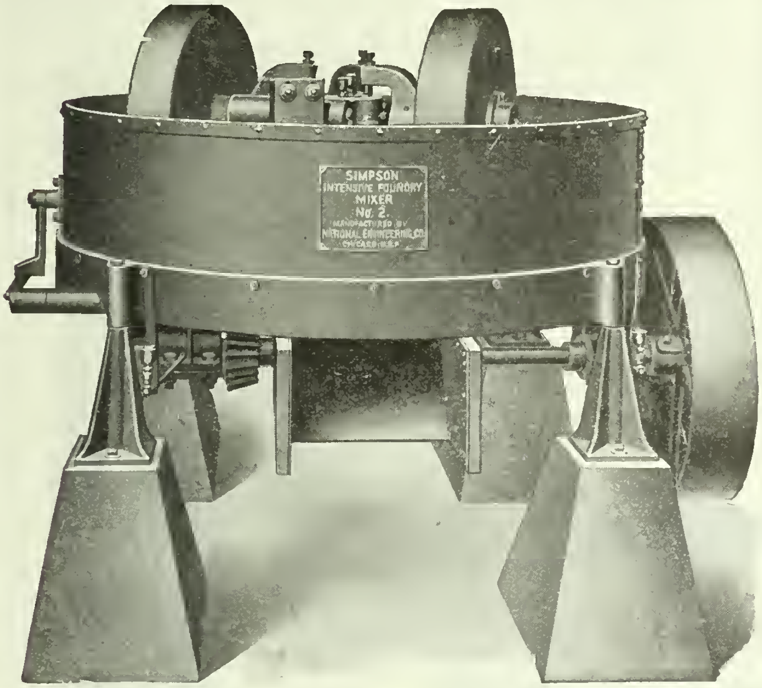
Mussens, Limited, 211 McGill St., Montreal.
Factory Supplies, Ltd., 244 Lemoine St., Montreal.
Williams & Wilson, 84 Inspector St., Montreal.
E. J. Woodison Co., Montreal.

Strong-Scott Mfg. Co., Winnipeg, Man.



Simpson INTENSIVE FOUNDRY MIXER

ECONOMICAL and EFFICIENT for all kinds of sand mixtures in foundries producing steel, gray iron, malleable, brass and aluminum castings



It is generally agreed—

among foundrymen that the efficiency of any new material entering a mixture depends practically entirely upon the effectiveness of the mixing unit, regardless of whether the new material be new sand, clay, dry or wet binders. In the introduction of new molding sand or clay, it is necessary that the action of the mixing unit be of such a character as to surround each grain of old or burnt sand with the thinnest possible coating of the new sand or clay. When a dry or wet binder is being used, it is likewise absolutely necessary, to coat each grain of sand with the dry binder, or wet binder, or oil, whichever may be used. That the muller type of mixer as exemplified in the SIMPSON INTENSIVE FOUNDRY MIXER is best suited for this work has long been conceded. The greater efficiency that we claim for the SIMPSON INTENSIVE FOUNDRY MIXER is due to the squeezing and kneading action obtained by the mullers together with the constant turning over of the sand by the proper arrangement of the plows. The mixture in this manner is changed from a friable and a loose condition to a strong, tough and plastic mass.

IN AN ORDINARY FOUNDRY of forty to fifty molders, the attention of one man is all that is ordinarily required to mix all of the core sand and facing sand for the entire shop, which is a very great saving of labor when compared with the very inefficient idea where every molder mixes his own facing sand by hand. Generally, the saving effected by the concentration of the sand mixing operations **will amount to the price of the Mixer in a few months.**

The Product of a Practical Foundryman

NATIONAL ENGINEERING CO.

549 W. Washington Blvd. CHICAGO, ILL.

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS

Member of the "Audit Bureau of Circulations"

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Machine Cast Pig Iron Increasing in Popularity

Canadian Furnace Co. Installing Machine at Their Port Colborne Furnace—Review of the Old and the New Process—Different People's Opinions—Expenses About Equal

CANADIAN Furnace Co., Toronto, who have for some years past been operating blast furnaces at Port Colborne, Ont., manufacturing "Victoria" brand of pig iron, and for which M. A. Hanna & Co. are the Sales Agents, are, among other things, installing a pig casting machine, to take the place of the big beds formerly used, and aim to have the machine cast pig iron on the market in January. The pig casting machine seems to be a feature of modern pig iron production which bids fair to become universal in the near future, and this fact should interest readers of Canadian Foundryman in studying the pros and cons of this process compared with those of the old sand method. While both "machine cast" and "sand cast" have their adherents and advocates, there is really little or no difference in the quality of metals. What it is, it will be, no matter what kind of a mold it is poured into, but at the same time the casting machine has advantages, which can not be denied. There is no sand burned onto the surface of the pig to be paid for on the invoice as well as in melting and fluxing. The pigs which come from the machine molds are all iron and of uniform weight.

There are a number of these machines in operation in Canada already, so that this installation is not a new venture in the Canadian field, but it is a venture in the right direction.

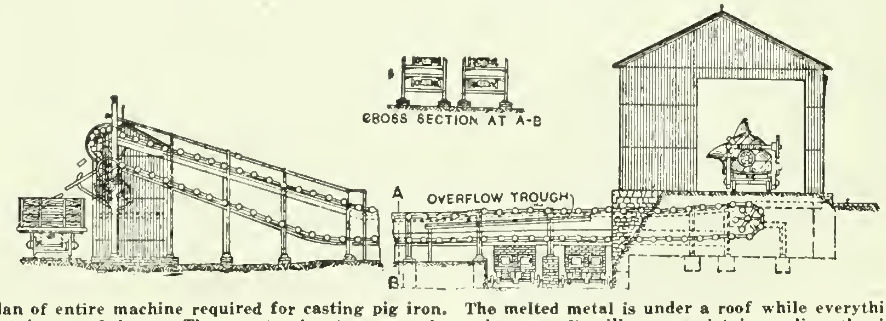
There are several different types of casting machine in use; some consist of a horizontal revolving disc with molds on the periphery, while others of the endless chain variety have stamped steel molds, but the one which meets most favor is of the type which is being adopted by Canadian Furnace Co. This machine is being built in Canada and the molds are cast from basic pig iron which is the most durable iron to withstand the continuous heating. About fifty tons of iron was used in its construction. The principle on which the machine works is to have a pair of endless chains, supported by wheels which run on a track and which carry a series of iron molds, similar in appearance to the molds frequently seen in foundries for receiving left over metal. These molds are about two feet in length and have a flange at each end to fasten the chains to. Each mold would weigh about 250 pounds and has a bridge wall in the middle which will cut the pig almost in two. The pigs weigh about 125 lbs. and will break easily into pieces which will be of proper weight for charging. The trackway is approximately horizontal, except at the delivering end, where it rises so that the pigs fall into a car or in a heap which may be transferred by magnet to railway car or to storage pile. A portion of the horizontal track is depressed and passes through a tank of running water, which cools the pigs on the outside sufficient to hold them from breaking to pieces when falling out of the mold. This also keeps the mold cool, otherwise it would keep getting hotter each time.

After the molds dump their burden at the delivering end, they return to the receiving end on a lower trackway in an inverted position, passing over an apparatus which sprays them with lime water, which will dry from the heat of the mold by the time it gets to the spout again.

Unlike the sand bed method where the metal is run direct from the furnace onto the floor, the machine cast pigs are poured from a ladle. This ladle might hold anywhere from 50 to 100 tons of iron. It is on wheels and is drawn by a locomotive and placed under the spout. When filled, it is drawn around to the casting shed, which is simply an open-sided building with roof to shelter the workmen and prevent rain and snow from getting onto the ladle or the pouring basin of the machine. The remainder of the machine is outside, since the weather does it no harm.

The pouring basin is on a trunnion similar to the tilting spout on a cupola which serves trolley ladles. This basin is simply a long spout with a recess in the back to hold a reserve of metal. The spout end is situated directly above the pig mold, and when all is ready the spout is tilted so as to fill the mold, after which is tilted back. The filled mold is now moved ahead so as to follow an empty one to come in line. This is worked something after the order of the cylinder of a revolver, which always stops in exactly the right place, with a friction clutch to hold it. The pouring ladle keeps up a continuous stream, while the mold-filling is regulated by the tilting spout.

As already stated, there are diverse opinions on the good and bad features of the two methods. It is hard for the average, old time foundryman who has never taken any interest in chemistry to realize that chilling a casting does not in any way change the analysis of the iron, either for better or worse, as it neither adds nor takes from it. The two following articles which were published some time ago in "Iron Age" will show that opinions are divided, and that there are those who still maintain that sand cast pig is the best for foundry use while the chilled pig may be more suitable for steel. The first one, written by J. P. Dovel, furnace manager of the Sloss-Sheffield Steel and Iron Co., Birm-



Plan of entire machine required for casting pig iron. The melted metal is under a roof while everything else is out of doors. The worst rain storm can do no harm as it will only assist in cooling the pigs, while the empty molds will be bottom side up, when returned.

ingham, is along this line, while the second one, written in reply to this, is of the opposite opinion. Following is the first one:—

The casting of pig iron was always done in the open sand until the manufacturers of steel commenced casting in metal molds in order to eliminate the silica that adheres to the surface of the pigs, this silica being objectionable in the steel furnaces. This contention has become so general that all purchasers of commercial basic or Bessemer iron would require in their specifications that the iron be cast in chills or on casting machines.

The reason given does not apply to the casting of foundry iron, as the small amount of sand sticking to the surface of the pigs would do no harm at all. It would, of course, add some weight to the iron that would be of no practical value, but all makers take care of this feature by allowing the gross ton of 2240 lb., being about 18 lb. per ton for sand, or practically 1 per cent., and it is not likely that sand cast irons carry 1 per cent. of sand into the cupola.

Sand cast iron in appearance presents a rough surface; whatever dirt, sand or kish it carries is always on the outside, none ever showing on the inside. Machine cast iron in appearance presents a smooth surface. The casual observer would believe that it is very clean iron, but on close examination it will be found that large quantities of kish have been actually inclosed within the pig. This kish and dirt that would generally stop in the runner, or float on the surface, in sand cast methods is being inclosed in the pig in machine cast methods. It seems that this condition could be relieved to some extent by some practical skimming method or by the use of a long runner in the sand before going into the ladle. The latter method would be a little out of line with machine practice, as it would mean the return of more scrap to the furnace. This, of course, nobody prefers, but it would certainly be better practice than to let the kish and dirt be molded into the pigs and charged into the cupola where it may cause trouble in the foundry and in the finished castings.

Another reason why melters of foundry iron do not prefer machine-cast pig is probably the chilling effect that the metal mold has on the molten cast iron. This principle is the thing that makes it possible to produce a good car wheel from cast iron, and is also the principle that makes it impractical to mold commercial castings in metal molds. **The principle is well understood by foundrymen, and under it we must admit that iron cannot be molded in metal molds without materially lowering the grades, which consists in changing a part of the graphitic carbon to fixed carbon.** Such a change would be permissible only to a limited extent, as the relation of fixed carbon to graphitic carbon content of foundry iron is the chief item in deciding value.

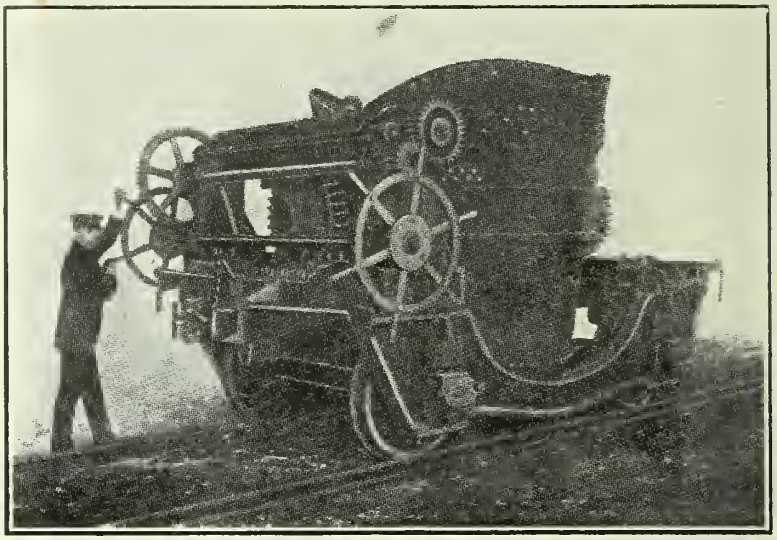
It would be impossible to make a good casting with the carbon content wrong, no matter what the analysis of silicon. sulphur, phosphorus and manganese may be. In making this statement I do not wish to be understood to say that I would recommend ignoring the analyses of sulphur, silicon, phosphorus and manganese, all of which are highly important and should be correct for the various purposes for which they are required. But I do say that the state of the carbon may be fatal in good foundry practice and that methods that tend to interfere with the proper ratio of fixed and graphitic carbons should be avoided, no matter whether it is bad practice in casting or bad practice in furnace methods generally.

The large output of our modern furnaces and the shortage of labor of the kind for handling of pig iron in the old way has made it imperative to find a better way to do this work of casting and handling. **The pig casting machine has come along with its labor saving advantages and filled this place splendidly for steel making irons.** The pneumatic hammer has come into use recently for breaking sand cast into pieces of desirable sizes, which was about impossible by the old method of breaking by hand.

The sales departments of commercial foundry furnaces have had more complaints from customers about iron not being properly broken than all other causes combined. There is at the present time a feeling among foundrymen that iron should be charged into the cupola in smaller pieces than is commonly the case, to insure a quicker and more uniform melt. This would apply especially to the high grades that are used extensively in the mix as corrections for off grades or cheaper grades. This condition can be met nicely by the pneumatic hammer system of breaking.

In reply to this, the following letter was written by J. W. Porter, vice-president of the Alabama Co. of Birmingham:—

To the Editor: It seems that Mr. Dovel, in April 21 issue of The Iron Age, worked pretty far afield in his arguments covering "Why Foundry Iron Should be Sand Cast." He admits that for economic reasons the manufacturers of steel prefer and insist on machine cast basic pig iron as compared with sand cast iron, yet does not admit that for the same reasons gray iron foundrymen prefer machine cast iron. In the first instance, why should a foundryman pay pig iron freight rate on sand when he is able to secure an iron free from this "dead expense"? Also why should he desire to burn more coke and use more limestone to fuse and flux sand and to heat slag? Regardless of sand allowance made in the purchase of sand cast iron the same comparative saving ratio exists in favor of melting machine cast iron, amounting to approximately $1 per ton at the furnace in to-day's market price.



Hundred-ton ladle which can be handled in perfect safety by one man. This ladle can be filled at the furnace and taken to the machine, wherever located. Machine and ladle are always ready. No pig beds to get in readiness.

In regard to the so-called extraneous dirt and kish which is said to exist as an inclusion in machine cast pig iron, I believe, on reflection, Mr. Dovel will agree that any kish which becomes incorporated in the iron loses its identity as kish and becomes known as graphitic carbon—the name kish being applied to carbon which becomes entirely separated from the iron and either forms with the conglomerate scoria which sometimes attaches itself to tops of pigs and runners, or else floats in the air of the cast shed. However, on remelt in the cupola this scoria enters the cupola slag, because its low specific gravity will not permit it to be retained in hot. fluid cupola metal. In fact the dissociated kish will be blown from the cupola by the blast. Any extraneous dirt would seek the same disposition in the cupola slag. If, for any extraordinary reason, dirt should become entrained in machine cast or sand cast pig iron, it would immediately become released on remelt of the iron in cupola on the same principle that the "burned in" sand on sand cast pig iron becomes released on remelt and finds its way into the slag.

The comparison made by Mr. Dovel between car wheel metal and machine cast pig iron does not jibe with metallurgical practice. There is a vast difference between the two metals, car wheel metal being low in silicon (0.60 to 0.65 per cent.) and high in sulphur (0.11 to 0.13 per cent.), whereas machine cast pig iron is supplied with identical silicon and sulphur ranges under which sand cast pig is sold. However, this statement is not meant to convey the idea that car wheel metal is not first-class. As a matter of fact it is high grade, and the only reason its use is restricted in the gray iron foundry to small percentages in mixtures is due to the fact that the silicon being low and sulphur high, the metal mix would have to be siliconized by using ferrosilicon or silvery iron and desulphurized by the use of ferromanganese. These alloys cost money; therefore the foundryman prefers to accomplish the same purpose by purchasing pig iron which carries the required silicon and manganese to balance these elements in a mixture.

The cardinal point which Mr. Dovel stresses—that of the controlling factor of carbon—is eminently correct, but the weight of his argument would be directly in favor of machine cast pig iron if it were true that the carbons maintained the same ratio on remelt as exists in the pig. For example: a 2.25 per cent. silicon sand cast pig iron showing 3.05 per cent. graphitic carbon and 0.50 per cent. combined carbon would not be as strong as a machine cast pig iron of 2.25 per cent. silicon, 2.75 per cent. graphitic and 0.80 per cent. combined carbon. These are practically the ratios of carbons made as shown by the two kinds of iron.

However, luckily for sand cast pig iron, this phenomenon does not exist; for when either sand cast or machine cast pig iron is remelted in the cupola there is a readjustment of the combined and graphitic carbons to the degree sought by the cupola melter. That is: the 0.50 per cent. combined carbon in sand cast iron may be raised to 0.80 per cent., if desired, or the 0.80 per cent. combined carbon in machine cast iron may be lowered to 0.50 per cent., if desired. The carbon ratio adjustment is entirely controlled by proper mixing of metals, pouring temperature and rate of cooling. Molten metal at its higher temperatures contains carbon in solid solution. That is: a solution of iron and carbon. The rate at which the metal is allowed to cool determines the amount of graphite which separates out of the solution as pure carbon and the amount which is combined with the iron, and known as combined carbon. The carbon which combined with iron supplies the strong cementing qualities which produce strong castings, and the carbon which separates out as graphite flakes tends to break up continuity of metal matrix, thereby weakening the whole structure of the casting.

Mr. Dovel admits that the foundryman is entitled to a more uniform size of pig iron and suggests that automatic hammer breaking device supplies the need. The process is a great improvement over hand breaking method, but it remains a fact that cold broken pigs, sows and runners can never be made as uniform in size as liquid molded pigs. The writer admits that the foundryman is entitled to a uniform size of pig; as a matter of fact he is entitled to more. He should not only have a pig of dependable uniform size; but should have a clean pig iron with chemical analysis as to silicon, sulphur, phosphorus and manganese uniform throughout the mass of metal so that he may feel assured in calculating mixtures that all the iron is representative of the chemical analysis submitted. These features are combined in a machine cast iron—made possible by thorough agitation of molten metal from runner to ladle and ladle to uniform pig mold.

With due respect to everyone's opinion, there is no doubt but that the near future will see all pig iron cast in iron molds, as, in spite of the fifty-ton machine and the big ladles, there is no pig bed building required and no men to mold the pigs, and, all told, the expense on the machine cast should not exceed that of the sand cast.

DIDN'T REALIZE THAT THERE WAS ANY DEPRESSION

The Brantford Brass Foundry Company, which started operations in 1920, just when other people were making themselves believe that there was a depression, or even a panic raging, report that no such condition confronted them, or if it did, they did not let it bother them. In response to our solicitation they have submitted the following, which also announces that they have been organized as a joint stock company.

As recent as last winter the plant of the Brantford Brass Foundry Company consisted of a brick foundry, to which a storage shed was added and later a portion of this building was converted into a core room. In the spring of this year a machine shop was erected with an office building and was fully equipped. Electric power is now used and the furnaces are fired with fuel oil in place of the old coke fires. These additions were found necessary in order to keep pace with the steadily increasing business and the business is still increasing steadily. In fact we now regard it as absolutely necessary that an addition be made to the present foundry. This contemplated addition would give just about as much floor space again as we have at the present time and with this addition we could treble our output. At the present time we are working to capacity, and overtime work is often necessary to keep up with the orders in hand. Our customers are largely within a radius of twenty-five miles of Brantford.

We are now establishing a staple line of manufacture—builders' hardware and artware—which will, of course, be supplied to the entire Dominion and which is, in part, the reason for the proposed addition to the foundry.

The transfer from the Brantford Brass Foundry Company to the Brantford Brass Foundry, Limited, was made only recently and the authorized capital of the new company is one hundred thousand dollars ($100,000.00). The directors of the company are: D. L. Webster, president and general manager; Alfred Serjeant, vice president and superintendent of works; T. E. Hutton, secretary-treasurer and sales manager; H. W. Bennett and D. A. Hutton.

Mr. Webster was formerly the Chief Engineer of the Brantford Water Works System and was later a Water Commissioner in this city. Up until the transfer of the Brantford Brass Foundry Company to the new concern he was the proprietor of the former.

Mr. Serjeant, who is an old countryman, is a practical moulder, having been at the business all his life. Before coming to this country he was a partner in a brass foundry in London, Eng., doing a flourishng business, but came to this country because he realized that opportunities in the Dominion were greater than they were at home.

Mr. Hutton was formerly connected with a large manufacturing concern in this city, in charge of the sales of some of their principal articles of manufacture. He has a good practical knowledge of the promotion and engineering of sales and is himself a salesman. He also has a good practical knowledge of accounting.

The Brantford Brass Foundry Company started to operate in 1920. This was the time when the general depression was felt very keenly. But in spite of the depression, the company progressed steadily, always increasing its business, until now it is going ahead by leaps and bounds. At the present time the future looks very bright indeed. We believe it has been the rule during the past two years for other concerns to mark time rather than progress, and therefore we believe it is very creditable to have been able to progress as this company has done, in face of the hard times, and such keen competition.

CHARACTERIZE YOUR REPUTATION

Reputation is what people say about you. Character is what you are. Reputation is your advertising. Character is that which you have to back up the advertising. No advertising continues to pay unless it is backed up with substantial service. The best way to maintain your reputation is to back it up with a sterling character.

Molding Wheel With Cores and Segment of Rim

If Powerful Crane is Available a Lifting Ring is Used and Outside Rammed First—If Not, the Inside is Finished Before the Outside is Begun

By F. H. BELL

I HAVE been asked to describe the sweeping of a band wheel with eighteen inch face and ten feet in diameter, one inch thick at the edges, and crowned in the middle of the face, with the least amount of expense for rigging, as the job may never be repeated and certainly, not very often repeated.

There are different methods by which it can be accomplished, according to what rigging is already on hand, but I will first describe the molding of a wheel of the simplest design until the novice gets his mind trained on the system and will then supplement it with such information as will be required to make a more difficult one.

In the illustrations, Fig. 1 is one which might be seen in any molder's text book, At E will be seen cores for the arms. If we make these the full depth of the rim we can have the hub formed without any additional cores but if not we will have to make cores for the top and bottom part of the hub. We will first make one with the cores the full depth, in which case we will require a core box half the depth, and with half an arm pattern attached to the inside. The inner end will be shaped as is laid out on the top of the illustration, while inside, the form of the hub wi'l be doweled to the end of the core box with loose dowels, or else the end will be left open and the hub swept with a strickle. The two half cores will be clamped together as shown at E. A flat bed can be struck off with straightedges if the shop is not in possession of a sweeping spindle. The cores will be carefully fitted together at the hub so as to not leave any cracks and so as to have the outer ends all spaced equally. A segment of pattern A must be provided, and this put in its place as shown and secured there by propping it against something or resting weights against it. The space between the arms will now be filled in with molding sand as shown at B, C, and D. After filling all the spaces and striking them off level on the top, the inside of the mold is done, and that is substantially all there is to the inside of any flywheel mold, but to make it this way we must have the cores 18 inches in depth if the wheel has an 18 inch face, and with probably three inches required for the arm the rest of the core is wasted.

Now supposing we have a spindle similar to Fig. 2 we sweep off a flat bottom in the pit and block the cores upon bricks or anything which will bring them to the proper height to be in line with the centre of the rim. In this case we simply require sufficient depth of core to cover the arm pattern. The extra depth of hub will be made up in a round core, for top and bottom, with core prints and hole for spindle to run through. Instead of a segment like E we have a segment made with the inside shaped as it should be, with a rib projecting inward for an inch or so connecting the arms, while the arm cores would, of course, have to be shaped on the outer end to correspond with this. An internal flange, top and bottom can also be on the segment rim if required. Instead of having the segment resting on the floor, it will be fastened to the sweep arm, so that, regardless of the cores, it will follow a true circle. Sand will now be filled in the same as before, only that it will have to be rammed under the cores and over them, and the segment will have to be used in line with the cores as well as between them. If there are ribs and flanges overhanging sand it will have to be rodded and vented.

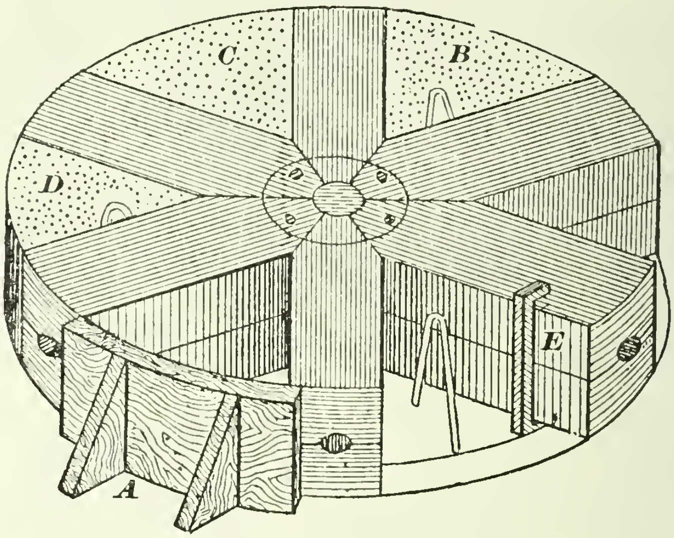


Fig. 1—Simple band wheel made up with cores and segment.

After removing the segment of pattern, the face of the mold is finished the same as any mold and painted with plumbago.

I might say that when the arm cores were blocked up before the sand was rammed between them, the core which forms the bottom of the hub was also wedged into place, and the spindle dropped down through it.

The inside being done, we now have to make the outside. If we had a lifting ring and a crane strong enough to lift it, we could have had the segment of pattern shaped properly on the outside as well as on the inside, and could have made the outside first and lifted it out of the way, but, not having this, we make the outside after finishing the inside. To do this we have a segment for the outside, but thinner than the rim is to be. This segment does not have to be fastened to the sweep arm, but depends on the cores and the inside of the mold for a guide. A strip of wood of the proper thickness is placed between it and the core at each end. This is so that, when the outside is all rammed, the strips can be removed and the segment can be pulled inward to the amount of the crown, after which it can be taken from the mold. There will be no chance to plumbago the outside, but good facing sand will make the face good enough, so it will probably be turned in the lathe. Flat cores will be placed on top to cover the rim and the core for the top of the hub, having opening for gate, will be put in place, and, of course, the centre core, after which the entire mold is weighted down, or, better still, if a couple of ring plates are poured in open sand they will cover all the cores, and if there are binder hooks in the floor the rings can be bound down with cross bars, otherwise the rings can be weighted. Wedges should be put between the rings and the cores so as to be sure that each core is securely fastened down. The top should be covered over with sand and a runner built from the hub to well beyond the rim so that it can be poured without risk of caving in the mold from walking too close.

Another method which works alright, providing we do not want internal flange top and bottom, but which requires a man who knows that his work is perfect when he leaves it, is to have the segment finished inside and outside just as the wheel is to be, and fasten it to the sweep arm. The segment would have to be no longer than the space between the arms and would be better if a shade shorter. The sand will be rammed inside and outside at the same time and as the seg-

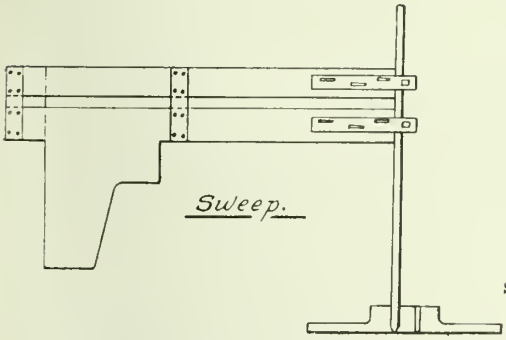
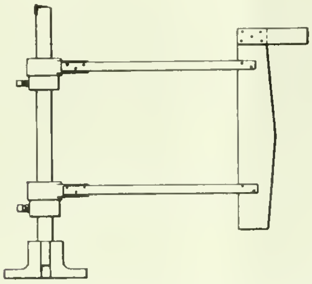


Fig. 2—Ordinary sweep and spindle which can be changed to suit any condition.

ment is moved around, the part which is rammed must be considered as done, since there is not much chance to retouch it. If we continue in this manner we get our mold rammed up all right, but we cannot get the pattern out, and this is why we had it made short enough to miss the cores. In ramming up the first space, it must be only rammed up half way and a parting made. From this the balance must be rammed on an iron anchor or lifter which can be lifted out. To do this, it is better to move the sweep out of the way so that the anchor can be pulled outward, in which way it can be drawn much more easily than trying to lift it straight up from between two rough cores. This section could be made of core sand and baked but this is not necessary. It should, however, be left out until the rest are finished. When the other five spaces are filled, the pattern will be around again to this open space where, after removing the sweep arm, it can be drawn out. It will, of course, require to have draft at least equal to the crown on the outside, or else it cannot be drawn inward so as to let the crown come up. When I say that the inside and outside would have to be done simultaneously I say it reservedly, because it would be possible to ram the inside all the way around before doing the outside, but it must be remembered that, unlike the first one, this pattern is only an inch thick where it is fastened to the sweep arm, and not much thicker anywhere else, and great care would be necessary to prevent it from springing, whereas the one with only one face finished could be several inches or a foot for that matter. It would, however, be quite possible to ram it part way up on the outside while ramming it full on the inside. This would give the molder a chance to finish around the centre rib, but he could not plumbago it because the pattern will be up against it when the rest of the outside is being rammed, as the plumbago will stick to the pattern. After the pattern is removed, the anchor carrying the first section is replaced and the mold proceeded with, the same as already described. I have seen flywheels made this way with the best of success, and where an occasional one is to be made, I would say it is as good a way as any.

Of course, there are better ways than



Sweep for rim when outside is done first.

any of these, where the business is sufficient. It is quite common practice to have patterns for every size of arms, and just build the rim around the arm pattern. In this case, the rim would be swept first and lifted away, after which the bottom half of the inside would be made and a parting cut between the arms. An anchor would now be put in place and the top half done. After lifting this away and removing the arm pattern, the parts are returned to place and the mold finished as in the other cases.

SAFE FOUNDRY PRACTICE

In following up any occupation it is always best to be on the safe side, and not run any unnecessary risks, since a finger clipped off or an eye knocked out cannot be replaced. We may secure compensation, but we cannot replace the lost member. We know all of these things but we do not always heed them. Insurance companies will take risks on workmen without binding them very closely to any set order of action, because they know that no sane man would deliberately put himself in the way to be injured, just for the sake of the insurance he happens to be carrying. They know, however, that there is unnecessary danger lying in the way of every workman no matter what calling he may pursue. They know that while cautioning the workman may have some good effect, it is not always successful in preventing accidents, because workmen are busy and with their mind on their work they overlook their danger. The most effective method of preventing accidents is for the employer to remove the dangerous man-traps which so frequently are the cause of distressing accidents. Insurance companies know this, and instead of cautioning the men, they point out the likely causes of trouble to the men higher up with a view to minimizing the number of accidents. One American accident insurance company publishes a book on safe foundry practice, which would be well worth reproducing, since it points out a lot of danger spots which may be avoided. From time to time these points may be brought out in these columns, but for the present we will extract some of the leading features from the preface of the book, which are as follows:

"The foundry, viewing it from all angles, presents one of the greatest problems in the industrial world. The fact that the production of castings depends not only on a mechanical process, but also on a chemical process, makes it specially difficult to fasten upon any individual responsible for imperfect work. And yet there is a definite (even though unassignable) reason for the loss of every defective casting produced,—some one member of the department failed in properly performing his part of the work. Every man must therefore be taught to appreciate the importance of his own particular task, and must be impressed with the necessity of performing that task conscientiously, and as correctly and efficiently as he can. There should be a spirit of co-operation as earnest and sincere as that which prevails in a beehive, where every worker performs the task of the moment with singleness of purpose, and with no thought or motive other than the production of the best final result, from the united labor of all. The development of a point of view of this nature among the men will also have a profound effect in the way of reducing accidents—a greater effect, in fact, than could be realized by any other single means.

"One of the problems that must receive special consideration in connection with accident-prevention work in foundries relates to the class of persons employed. It is not necssary to employ skilled labor for all the operations in the foundry, and for that reason a certain portion of the work is intrusted to unskilled help—to men, namely, who do not understand the necessity for safety methods. The most practical and effective way of dealing with a situation of this kind is to adopt the team-work idea—that is, to teach co-operation—and to introduce a well-organized safety department that will educate the men to the extent of developing in them sound and correct accident-prevention ideals. Useful, practical suggestions for accomplishing this, and for making the accident-prevention work effective, are given in a booklet entitled 'Organization in Safety Work.' which is published by the Engineering and Inspection Division of The Travelers' Insurance Company.

"Even the best-equipped, most orderly, and most effectively organized foundry is not free from accidents, and it is too much to expect that complete immunity

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Figuring Costs from Material to Product - No. 1

Opening General Ledger Accounts—Material, Labor and Indirect Expense—Beginning at Foundry in Estimating for Machinery Plant—Accounting for Every Detail

By A. LUENBERG

KNOW WHAT IT COSTS

This is the first of a series of articles on cost-accounting as having practical application in machine tool production. Questions, discussions or suggestions upon the different phases of the subject are welcomed.

INTERNATIONAL reconstruction and the business depression in Canada for the last two years have forced many Canadian manufacturers to look for export trade, and enter upon international competition. A comparatively small number of manufacturers know the cost to manufacture and sell, and unless that fact is known, success on the world market may be considered very doubtful.

No business man, no matter how small the business may be, should be without some kind of cost system. At the present time where nearly every manufacturer has to figure on large competition it is absolutely necessary to know accurate factory cost. Accurate knowledge of factory cost is the foundation to success, where ignorance may be the direct cause of failure sooner or later.

The installation of a cost system makes it at once necessary to open general ledger accounts for what makes up factory cost—material, labor, and indirect expense. To get a start, an inventory must be taken of all materials on hand at a certain time. Materials may consist of raw materials, parts in process of making or parts finished and ready for shipment. A separate account should be opened for each class and named something like the following, for a company manufacturing machinery:

1. Raw Material & Supplies.
2. Foundry Raw Materials & Supplies.
3. Foundry—Work in Process.
4. Machine Shop—Work in Process.
5. Erecting—Work in Process.
6. Finished Parts.
7. Rough Casting Stores.
8. Payroll Account.
9. Indirect Expense.
10. Completed Machines

Every account must be debited and credited at proper times, say monthly periods, as raw materials are received or work is proceeding in plant. The following description will deal with how to find accurate factory costs of rough-castings. The system is in operation at one of the largest Canadian manufacturing concerns in the line of machinery, making their own castings.

How To Find Cost of Rough Castings

(See "Foundry Cost of Production" report.) In order to get the actual cost of rough castings, it is necessary to know the exact cost of foundry raw materials at the plant. In charging the cupola, all pig iron, scrap iron, steel, coke, limestone. etc, must be weighed and a record of same kept by person responsible for heat report. Nothing must be overlooked, no matter how trifling; everything must be charged at its proper value. The total weight of materials entering the cupola at their cost price at the plant represent the cost price of raw material per heat.

FOUNDRY COST OF PRODUCTION REPORT.

Date........................

Tests and analysis

No.	Brake	Den.	Sil	Sulph.	Phos	M N
1	3050	26	1.90	.087	.58	.43

Material used	No. 1 Dept. Cupola lbs.	
Pig iron	13,000	$304.10
Home Scrap	7,000	157.50
Foreign Scrap	6,000	135.00
Steel	1,000	10.00
Shot	1,000	22.50
Total melt	28,000	629.10
Loss by shrinkage, 1.44%	405	
	27,595	629.10
Coke used	3,150	28.89
Limestone	700	.60
Wages productive		36.14
Wages, non-productive		11.80
Department's fixed overhead		69.64
Material produced and costs	27,595	776.47
Cost per lb. at spout .0281.		

	No. 2 Dept. Moulding. lbs.	
Material used	27,595	$776.47
Returns from Foundry	7.820	175.95
Castings produced	19,775	600.52
Wages, productive		382.34
Wages, non-productive		124.00
Department's fixed overhead		208.92
Material produced and costs	19,775	1315.78
Cost per lb., .06653.		

	No. 3 Dept. Core Room. lbs.	
Material used	19,775	1315.78
Core Oil, 7½ Gallons		7.50
Core Sand	3,960	3.96
Core compound, etc	176	3.78
Coke	1.400	12.84
Wages, productive		104.34
Wages, non-productive		33.81
Department's fixed overhead		59.64
	19.775	1541.65
Foundry bad castings	411	9.25
Material produced and costs	19,364	1532.40
Cost per lb.—.07865.		

	No. 4 Dept. Chipping lbs.	
Material used costs	19,364	1532.40
Wages, productive		57.27
Wages, non-productive		18.55
Department's fixed overhead		79.64
Good castings total cost	19,364	1687.83
Total cost per pound—.08716.		

In the above, figures assumed for example only.

Wages of cupola help, direct and indirect, as well as the department's fixed overhead charges, are then added to the cost of raw material. The result, divided by tonnage, gives what is called the price per pound at the spout.

The fixed overhead charge of a department is a proper share of general overhead expenses fixed for a certain department according to its size, its use of power, light and heat, its proper share of repair costs, maintenance and general administrative expenses, depreciation and, in many cases, selling expenses.

The next step is to include core-room expenses into cost. All core oils, core sand, core compound, coke, etc., used in connection with core-making for a heat must be kept track of, and charged against the heat, adding coremakers' and core-room helpers' wages as well as the department's fixed overhead charges.

Knowing cost of heat at spout and core-room expenses the moulding shop must be taken into account. The total of cost of heat at spout plus core-room expenses as explained above minus foundry returns (drop-shot-grates and sprues) at scrap iron cost prices; are the figures to work from.

Moulders' and moulding shop helpers' wages, supplies used and the department's overhead are added. The result divided by tonnage will give the price per pound of castings in mould.

To arrive at the final cost of rough castings, the chipping and cleaning department must be included. Chippers' and chipping room laborers' wages and the fixed department's overhead are added to cost of heat in mould. The foundry bad castings are deducted at scrap iron value giving the accurate cost of heat. Tonnage divided into cost of heat is price per pound of good castings produced by foundry.

In order to get accurate figures for all productive and indirect labor, it is best to employ a man to check the actual number of men, productive and indirect, working on a heat, and figure out their wages at rates paid. The same employee will have time enough to take care of heat reports, make out requisitions for foundry materials used by all departments, checking patterns and keeping a record of castings for each heat. The record of castings per heat is very important, checker must go to every moulder and find out pattern numbers and number of pieces in mould. In a foundry where a heat is taken off daily, the chipping department may not

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Heat Treatment of Steel in Crucible Furnaces

Uniform Heat of First Importance—Pressed Steel Pots Give Good Service—Avoid Overheating of the Work—Handling Parts in Quantities—Preventing Formation of Scale

APPLICATION of the crucible furnace for the heat treatment of steel is not an innovation, as old time steel masters knew of it and practised it with varying results, depending on their knowledge and ability to determine the temperature of the bath. In those days pyrometers were either unknown or unreliable, and Seger cones were relied upon for accurate results. The craftsmen of our fathers' days were trained to judge temperatures by color, and crucible furnaces using a molten bath did not readily lend themselves to this old method of judging temperatures, and the Seger cone could not be used. The top of the bath was generally covered with dross, or a slight film of oxide, thus making temperature judging rather difficult and generally too high. This characteristic of crucible furnaces resulted in the production of overheated work and the process fell into disrepute, even though conceded to be an excellent method for heat treating.

A careful study of this type of furnace was made in later years, and with the development of the pyrometer to where it could be relied upon implicitly, crucible furnaces have come into their own, and are specified by many manufacturers for use in the production of exceptionally ne heat treated work.

Furnace Construction

Crucible furnace construction for heat treating purposes requires to be especially designed to obtain maximum efficiency. It is not simply the placing of a pot within a setting of brick and applying heat to it. Uniformity of heat is the prime object of the process, and this can be obtained only after careful design and experimentation. The action of the flame is also important, as it should not strike directly on the pot, for this will shorten the life of the pot considerably. The design that has given great satisfaction is the circular type which permits the placing of the burners so that direct impingement of the flame on the pot is prevented and a swirling motion is given to the flame, causing it to encircle the crucible several times before passing out of the flue. This holds true for either gas or oil fired furnaces. Less economy is shown with rectangular furnaces, owing to the short contact and high velocity of the gases in the combustion chamber. In crucible furnaces pressed steel pots give greater satisfaction than either cast iron or cast steel, due to the greater ductility and higher relative heat conductivity of their thinner walls. The life of any pot is materially increased by proper regulation of the atmosphere within the combustion chamber. A reducing or soft flame is best.

Methods of Heating

In an oven furnace the heat is transferred by convection and radiation, as the furnace is so designed that the flame will not come in direct contact with the work. In the crucible furnace the heat is transferred by conduction, which is many times greater than any of the modes available in the oven furnace.

This is demonstrated by the example of one being able to hold the hand several inches away from a red hot object for quite awhile, the heat being transmitted by radiation and convection, but knowing better than to touch the red hot object for fear of being severely burned, the heat being here transmitted by conduction. So great is the difference between the two types that an illustration or demonstration is needed to convince the uninitiated before they will believe that a crucible furnace using molten lead will heat the work up about 70 times faster than an oven furnace. It takes about 12 seconds to heat a piece of 3/16 inch steel in a lead furnace at 1450 deg. F., while at least 15 minutes is required in an oven furnace maintained at 1450 deg. F. Since the crucible furnace heats the work up so rapidly, it is imperative to preheat all work of uneven cross section.

Uniformity of Heat

Rapid heating is not the only advantage crucible furnaces have over other systems of heating steel. They heat uniformly, and this uniformity of temperature is throughout the entire crucible of molten salts or metal, and is a positive guarantee that the pyrometer indicates the exact temperature of the work. Non-uniformity in heating necessarily results in non-uniformity in cooling, which is the cause of most of the warping and cracking in the hardening process, and hardening cracks are more often the result of uneven heating than defects in the steel, both of which are not inherent in the crucible heating process.

One of the greatest weaknesses in heat treating practice is that of overheating of the work. Both workmen and charge hands are frequently responsible in this respect. In crucible furnaces this excuse is not to be tolerated, as the workman cannot see the work all the time, and it heats too rapidly for him to withdraw it at the "right time." The removal of this one bane of the heat-treating room is sufficient to recommend the crucible type furnace, for it is an axiom of the heat treater that best results are obtained by hardening a piece of steel at the lowest possible temperature, and always on a rising temperature, never a falling one. The most important function of the crucible furnace, other than its delivery of rapid, uniform heat, lies in its production of work without any decarbonized surface or scale; in fact, when cyanide is used, carbon is actually added to the surface layer of the steel.

Crucible furnaces may be adapted to any requirements of the heat treating field, dependent entirely upon the man or organization. In the beginning they were used for heating only very small parts, where uniformity of "temper" was required, but larger furnaces have since been produced for handling large parts wherein uniformity of hardness is essential at minimum expense.

Crucible furnaces lend themselves admirably to heat treating carbon steels, and similar low temperature alloys hardening below 1600 deg. F., using lead or some of the compounds in the market as the heating medium. For high speed steel barium chloride was formerly used exclusively, in spite of its shortcomings, but today this salt has been displaced to a great extent by other compounds. For hardening of high speed steel, however, the crucible furnace has fallen into disuse within recent years, being replaced by the oven type furnace and double deck furnace (see illustration), due principally to the fact that high speed steel parts are generally not very numerous.

The use of the crucible furnace for tempering at any temperature below 1,200 deg. F., is quite common. For lower temperatures the oil tempering furnace is used, as shown in illustration. This furnace when a high flash point oil is used will operate as high as 650 deg. F. nicely, after which a furnace of the rectangular crucible type, like illustration, must be used with an alloy of lead and tin as the heating medium. Using the crucible furnace for tempering overcomes the many weaknesses of the color tempering process, removing the personal element and cutting down labor costs to a negligible figure, as thousands of parts can be tempered at a time.

Carbon steel is the most generally used grade and where this steel is to be hardened lead works very satisfactorily. Here are a few suggestions in

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As recommended by the American Gear Manufacturers' Association.

Avoiding New Patterns by Changing the Old Ones

Many Patterns Which Have Served Their Purpose Can be Made Over for a Different Job With Much Less Expense Than Would be Required to Produce New Ones

By Joseph Homer, in Foundry Trade Journal

THE significance of these alterations is appreciated by no one so much as by the foreman patternmaker, who is responsible for the accuracy of the patterns that are subjected to alterations. These are a fruitful source of error in several ways, errors in moulding, and at subsequent periods when the patterns are wanted as they were originally. Some are altered with no regard to consequences, the need of the present only being considered. Others are treated in a more systematic and rational manner, both to avoid unnecessary cutting and to leave some kind of permanent indication or record of the alterations which have been made. In some cases patterns are constructed in such a way as to facilitate alterations and modifications in outlines. Often this includes methods involving stopping off with no cutting.

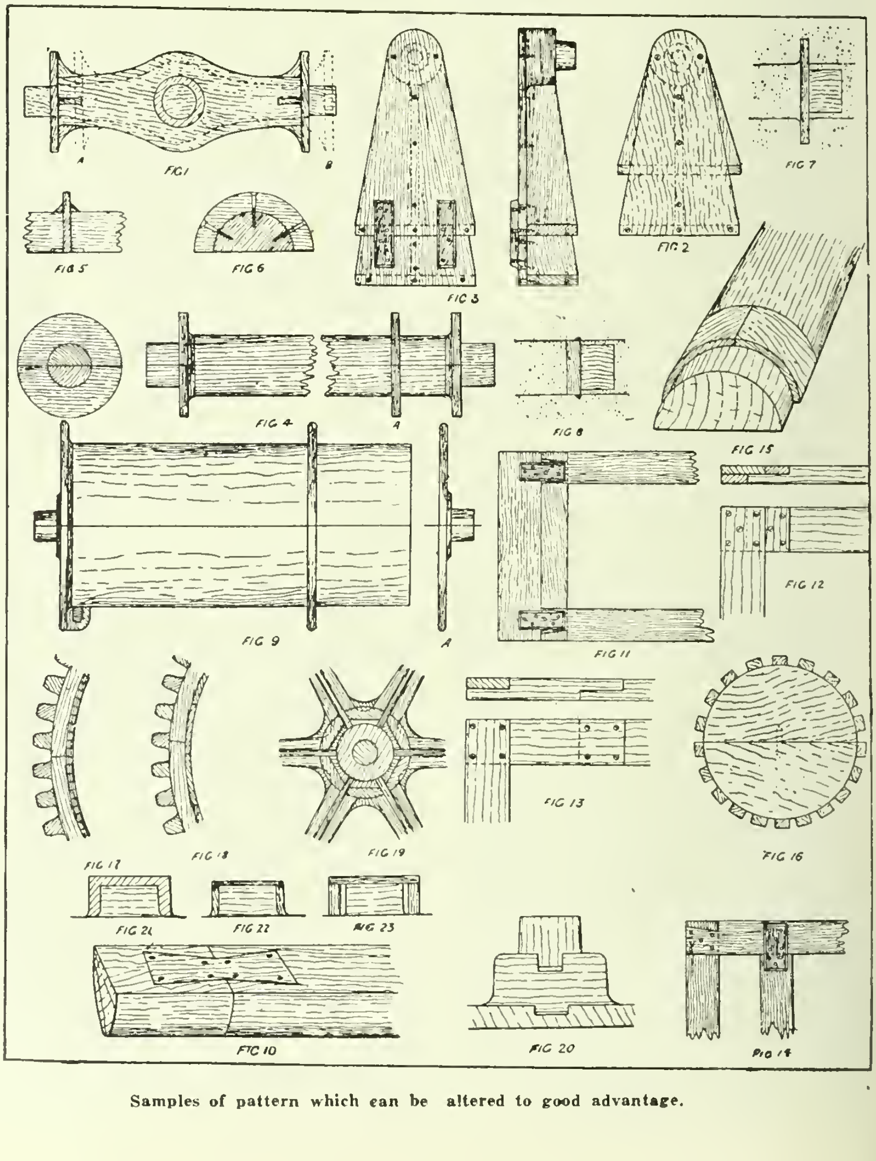
Alterations might be very broadly classified under two heads—reducing and extending dimensions—each with or without modifications in outlines. The first kind is usually the more objectionable, not so much in itself as in the subsequent errors to which it might give rise. When such a pattern has to be used later to enlarged dimensions, the original ones, patching has to be adopted; and this may often involve more work than the original cutting down did. Some kinds of additional fittings may cause the moulder trouble; while there are cases in which it is almost impracticable to enlarge patterns properly, as when they are flimsy or are cut into varied outlines.

Taking the cross-girder pattern for a crane, Fig. 1, if this has to be shortened for a small order, to cut the pattern at each end is not adopted. The provision for a new end is outlined by the flange dotted at A. The mould is made good with a stopping-off piece of the same shape. Should this pattern have been cut back to A, with the necessity of extending it later to the original length, fresh pieces must be fitted with abutting joints, with screws inserted diagonally, or battens, to be stopped off. This is a weak and clumsy job. If a casting has to be lengthened, pieces are fitted at the extended length as at B, and the mould is stopped off. When the pattern is restored to its original form, these pieces can be put back into the stores for future use. If apparently this is not satisfactory, it must be remembered that in almost every case it is better to stop-off than to cut patterns which have to be altered to their original dimensions. The interior of the casting in Fig. 1 is produced with a core, the outline of which is dotted and the prints for which are seen on the flanges.

A bracket can be shortened or lengthened at its foot end, or at the bossed end by stopping off, employing the methods shown in Fig. 1. The foot, Fig. 2, for shortening is fitted to the new position required, and the sand beyond the new foot is stopped off, using either a stopping-off piece or plain strips. To cut such a pattern and then extend it afterwards would be more expensive than to make two separate patterns. There is no great gain in stopping off in this plain example, but it is typical of more elaborate patterns. Fig. 3 shows a pattern bracket lengthened with a temporary foot attached with battens. The edges of the web and rib in the original pattern must not be cut, but stopped off.

Shortening by stopping off is regularly practised in column, pipe, and crane-drum work. These patterns are standard, and are never altered; but make-up lengths of castings and jobbing orders are provided for with patterns and parts that are stored specially for alterations.

A pipe pattern, Fig. 4, has a loose flange A fitted on its body, or a socket or spigot similarly, either of which can be adjusted for length and screwed on. The body flange may be set with brackets, Fig. 5, to be stopped off, or be fastened with screws, Fig. 6. A stopping-off piece is inserted in the mould and forms the new print impression, and stops off the redundant length of pipe.



Samples of pattern which can be altered to good advantage.

Fig. 7 illustrates the stopping-off of a pipe flange, and Fig. 8 that for a spigot end, the work having been completed. A crane-drum pattern is made in the first place as long as the longest casting likely to be required, and one flange is secured permanently to one end, Fig. 9. Different lengths are cast by screwing a body-flange on at the length required, and then stopping off the length beyond with a piece similar to A, Fig. 9.

Much pattern alteration is made in pipes, bends and tees. In most instances lengths are extended, and bends and tees attached with dovetails, as in Fig. 10. These are amply secure if well fitted, so that they pull the parts together. They vary, with pipe dimensions, from ¾in. to 1¼in. thick.

When plane pieces have to be lengthened or widened, it is impossible to put screws in directly, as they can be through additions of an inch or two wide only. In such cases screws may have their heads sunk in deeply. Tightly fitting dowels, or short battens, Fig. 11, to be stopped off, may be used. These methods are suitable when boards have to be only moderately widened. Or a slight extension can be made, as in Fig. 12. But when a framed pattern has to be extended so much that a single strip of board would not be wide enough, the frame can be extended, as in Fig. 13, with half-lap joints, and then no stopping off is required. When a frame has to be shortened it need not be cut. If a strip is secured with battens at the shortened position, Fig. 14, the supplementary position can be stopped off.

The enlargement of cylindrical parts may be continuous, Fig. 15, which occupies rather too much time; or it may be done with strips, Fig. 16, the interspaces to be filled with sand to make a continuous surface to be rammed against. Fig. 17 shows a strip, saw-kerfed, and bent round the interior of a wheel rim that requires strengthening—a method suitable for many cases where the strip is not too thick. Fig. 18 is the method of Fig. 15 applied to the inside of a rim.

When bosses have to be enlarged considerably, diagonal blocks are fitted, as in Fig. 19, held with screws put in diagonally. Bosses in general should be made interchangeable with a standard stud, as in Fig. 20, with core prints also having a standard size of stud. But this is only practicable when there are no arms of other attachments, like those in Fig. 19. When the original boss is a fixture and a permanent portion of the pattern, then larger bosses can be fitted in any of the three ways, Figs. 21 to 23, in addition to that shown in Fig. 19, the shells illustrated being cut to fit other arms or other parts. Fig. 21 is not a good method, because the shell boss is turned from a solid piece, and is therefore weak and liable to shrink. It is only suitable for a temporary fitting. In Fig. 22 sweeped pieces are fitted between arms, and are covered and retained in their positions with a plain disc over them. The same method is shown in Fig. 23, but the enlargement is greater.—"Foundry Trade Journal."

HEAT TREATMENT OF STEEL

(Continued from page 19)

using lead: It is very necessary to place a hood over the furnace to carry off any lead fumes which may arise from the pot. Charcoal or old carburizer may be used to cover the surface of the lead to prevent oxidation and lessen the sticking of the lead to the work. Slag should not be thrown away, as it can be reduced back to the metal while red hot on top of the pot by means of charcoal.

It is common knowledge that when a piece of steel is heated in an oven furnace in which an oxidizing atmosphere is maintained, its surface is decarbonized for quite a depth. This cannot happen in a lead pot, and for this reason the lead pot furnace continues to be, as for years, the one furnace in which files can be successfully hardened.

Many baths and compounds are on the market, any of which should be satisfactory, providing their melting points are correctly chosen for the temperature at which they are to operate. For example: If a drawing temperature of 720 deg. F., is desired, a temperature too high for oil and a trifle too low for lead (M. P. 621 deg. F.), as it would freeze all over the parts and be slow work, some tin could be added to lower the melting point to 450 deg. F., or a mixture of potassium nitrate 2 parts, sodium nitrate 3 parts, melting at 450 deg., F., could be used.

A table of the salts commonly used to compound these baths follows:

Salt	Melting Point °F.
Barium Chloride	1580
Sodium Chloride	1418
Potassium Chloride	1346
Calcium Chloride	1328
Magnesium Chloride	1306
Lead Chloride	932
Cupric Chloride	928
Ferric Chloride	572
Zinc Chloride	504
Aluminum Chloride	356
Potassium Carbonate	1526
Sodium Carbonate	1317
Lithium Carbonate	1283
Potassium Nitrate	644
Codium Nitrate	572
Calcium Fluoride	1832
Magnesium Fluoride	1664

Of the above salts calcium chloride combined with sodium chloride and admixtures of sodium carbonate are most generally used.

One of the most common baths is lead of commercial purity, which melts at 621 deg. F., and may be used up to 1,600 deg. F., satisfactorily. In order to prevent the adherence of the lead to the work it may be dipped into a solution made up of 1 pound potassium cyanide dissolved in 1 gallon hot water, and thoroughly dried.

1. Crucible furnaces for heat treating have been in use after a fashion for many years, their revival and widespread use to-day being occasioned by the perfection of the pyrometer, whereby the temperature may be controlled.

2. The construction of a crucible furnace is the result of considerable experimental work, the circular type being found most satisfactory.

3. Comparative merits of the oven type furnace when compared with the crucible type show the crucible furnace to heat the work at least 70 times faster without scale, decarburization or non-uniformity, which tends to produce better work.

4. High speed steel and carbon steel hardening and tempering are all done in crucible furnaces very satisfactorily. High speed steel hardening in barium chloride is being abandoned in favor of the double-deck oven type furnace, due to the preheating feature. Carbon steel, readily hardened in lead or any of the numerous salts, compounds or cyanided, is being carried out more than ever in the crucible furnace, because of its many desirable features. Oil or low temperature tempering is commonly done in a crucible furnace.

5. The use of lead as the heating medium for carbon steels is common practice.

The use of the crucible furnace is now established as one of the most accurate and satisfactory methods of heat treating small parts in quantity, where scale or decarburizing cannot be tolerated or where an increase in the carbon on the surface is desired by cyaniding. The process is productive of accurate work, uniformly heated, even when unskilled labor is used.

FIGURING COSTS FROM MATERIAL TO PRODUCT NO. 1

(Continued from page 18)

be able to get castings of one heat cleaned up every day. By checking castings leaving foundry against castings on heat lists, the employee making out the heat reports will be able to find out just when the last casting of a previous heat has left the foundry and enable him to finish report for that heat. This record of castings per heat must also show the number of hours moulder put in on a certain number of castings. The foundry foreman should look over this record and find out if time put in on jobs is O. K., and if not he can at once go after offending party and in such a way help to keep down foundry cost of production.

For all raw materials and supplies used in connection with heats for a certain period:

DEBIT:—Foundry work in process.
CREDIT:—Raw materials and Supplies.

For all castings finished and delivered by foundry to casting stores:

DEBIT:— Rough casting stores.
CREDIT:—Foundry work in process.

The Treatment of Carbon Monoxide Poisoning

Fumes From Cupola, Gas Engine, Leaky Stove or Any Place Where Carbon Gas is Present, Are Injurious to the Health, on Account of the Effect on the Blood

By R. R. Sayers and H. R. O'Brien

The rank smell which emanates from the cupola when it does not "light up" properly, or when back draft forces it into the working quarters, is caused by what is here referred to as carbon monoxide. It is a product of the incomplete combustion of carbon in the fuel, and while every foundryman knows that it gives him a headache, if he knew exactly what else it was doing he might treat the matter more seriously. He would not eat his lunch beside an open-topped coke salamander, belching out carbon monoxide. This article was prepared for the United States Public Health Service by two of their most eminent surgeons and is well worth reading by all those who are called upon to expose themselves to this deadly poison.—Editor.

Carbon monoxide poisoning is one of the most widely distributed and most frequent of industrial accidents. The gas is a product of incomplete combustion and is without color, odor, or taste; therefore, its presence is frequently unsuspected in many places where it exists. It is an ever-present danger about blast and coke furnaces and foundries. It may be found in a building having a leaky furnace or chimney or a gas stove without flue connection, such as a tenement, tailor shop, or boarding house. Hospitals receive a great number of victims of poisoning, whether by accident or in an attempt at suicide, from artificial illuminating gas. Persons may be affected by leaks wherever water gas is formed or used. The exhaust gases of gasoline automobiles contain from 4 to 12 per cent. of carbon monoxide, and in closed garages men are not infrequently found dead beside a running motor. A similar danger may arise from gasoline engines in launches. The gas is formed also in stoke-rooms, in gun turrets on battleships, in petroleum refineries, and in the Leblanc soda process in cement and brick plants. In underground work carbon monoxide may appear as the result of shot firing, mine explosions, or mine fires, or in tunnels from automobile exhausts or from coal or oil burning locomotives.

Carbon monoxide exerts its extremely dangerous action on the body by displacing oxygen from its combination with hemoglobin. Hemoglobin, the coloring matter of the blood, normally absorbs oxygen from the air in the lungs and delivers it to the different tissues of the body. The affinity of carbon monoxide for hemoglobin is about 300 times that of oxygen. Because of this, even when only a small amount of the poisonous gas is present in the air breathed into the lungs, much of the hemoglobin is locked up in combination with carbon monoxide and so cannot keep up its usual work of carrying oxygen to the tissues. These, because of the lack of oxygen, cannot do their work properly. If they are smothered long enough, the tissue cells become damaged, and the injury to the cells may be permanent even if the patient survive. It has been asserted that carbon monoxide has a specific poisonous action on some tissues of the body, especially those of the nervous system, but there is little evidence in favor of this statement and much against it. Haggard and Henderson found that there was no change in the rate of growth of chick brain tissue, even when it was exposed to an atmosphere containing over 70 per cent. of carbon monoxide, and it has been shown many times that animals without red blood (hemoglobin) can live in atmospheres containing high concentrations without apparent harmful effects. Recently this was demonstrated at the Pittsburgh experiment station of the United States Bureau of Mines, when some roaches were kept for several days in an atmosphere of over 60 per cent. carbon monoxide and 20 per cent. oxygen without lessening their activities.

The victim of acute carbon monoxide poisoning usually experiences the following symptoms: Yawning, sleepiness, weariness, and a feeling of constriction across the forehead; frontal headache, at first dull and intermittent, later continuous and more severe; this headache is replaced or masked by the typical headache of carbon monoxide poisoning, at the base and back of the skull, which causes the sufferer to hold his head as far back as possible in an effort to obtain relief; dizziness, nausea (feeling of sickness) and lassitude also occur. The pulse is at first normal, but later becomes full and rapid, the skin is flushed, the respiration becomes more rapid as exposure to the gas continues, and later becomes irregular. If the exposure is sufficiently long, or the concentration of carbon monoxide is sufficiently great, confusion and unconsciousness develop. As the victim recovers, he remains weak for some time. This weakness persists especially in the muscles of his legs. A headache, sometimes very severe, confusion, and partial loss of memory accompany recovery, but pass off in time. The nausea may be sufficient to produce vomiting. All the symptoms are accentuated by exercise, eating and stimulants. When a person is overcome by large concentration, the symptoms follow each other rapidly and he may fall quickly unconscious. The rate at which a person is overcome and the sequence in which the symptoms appear depend on several factors, viz, the concentration of the gas; the extent of physical exertion; the state of his health and individual predisposition; and the temperature, humidity, and air movement to which he is exposed. Exercise, high temperature, and great humidity, with no air movement, tend to increase respiration and heart rate, and consequently, result in more rapid absorption of carbon monoxide.

In chronic exposures, carbon monoxide poisoning produces a tired feeling, headaches, nausea, palpitation of the heart, sleepnessness, and sometimes mental dullness. Some persons develop a "tolerance" for carbon monoxide and may, after repeated exposures, be able to "stand" more of the gas than when first exposed to it. In the treatment of the chronic form of poisoning the most important factors are the removal of the patient from further exposure to carbon monoxide, and a thorough rest. Though there are probably many more cases of the chronic form than are usually recognized, it is in the treatment of the acute form that interest is generally centered.

The first and most important thing in caring for a case of acute carbon monoxide poisoning is to get the poison out of the blood as rapidly as possible. Every moment during which oxygen is shut out of the hemoglobin adds to the chances of failure of heart and respiration. Every minute during which the tissues are supplied with only a part of their needed oxygen increases the danger of their subsequent degeneration and permanent damage. Both to save life itself and to prevent ill health in the future, it is of vital importance to eliminate carbon monoxide from the blood as rapidly as possible.

Oxygen will replace carbon monoxide in combination with hemoglobin whenever the proportion of oxygen in the lungs is overwhelmingly greater. The speed of the change depends on the relative amounts of the two gases in the lungs and on the depth and frequency of carbon monoxide which he is breathing; the next is to supply him with oxygen. The first may be done by getting the patient into fresh air, but only one-fifth of air is oxygen. If a tank of pure oxygen is available, it is far better to use it as the action is much faster and the after-effects, especially the headache, are much less severe and not so prolonged. The oxygen should, if possible, be given through an inhaler similar to an anesthetic mask or the Tissot army face mask, which can be fastened over the patient's mouth and nose, or entire face. If an inhaler is not at hand, a physician may give oxygen through a nasal catheter. In the absence of any of these accessories, it can be sprayed directly from the tank about the patient's face. It should be started as soon as he is removed from the carbon monoxide or before, if possible, and should be kept up for at least 20 minutes.

It may be that when the victim is found his breathing has stopped, or is very weak and irregular. In this case one of the rescuers should begin artificial respiration at once, by the Schaefer method as follows:

Place the person on his abdomen; remove from his mouth all foreign bodies, such as false teeth, tobacco, and gum; see that the tongue is forward; turn his head to one side and rest it on his forearm, so that the mouth and nose will not come in contact with the ground, and extend the other arm forward. If the person is thin, prepare a pad of folded clothing, or blankets, and place it under the lower part of his chest. Do not make this pad too thick. Do not wait to loosen the victim's clothing, but begin artificial respiration without delay. An assistant may remove all tight clothing from the victim's neck, chest, and waist, and place blankets, hot-water bottles, safety lamps, or hot bricks, well wrapped in paper or cloth, about the person.

Kneel, straddling the person's thighs and facing his head. The palms of your hands are placed over the short ribs, with your thumbs parallel with the spine about 2 inches apart and your fingers spread out as much as possible, the ends of the little fingers reaching just below the last rib. With arms held straight, swing forward slowly so that the weight of your body is gradually brought to bear on the person. This operation, which should take about two seconds, must not be violent, lest the internal organs be injured. The lower part of the chest and also the abdomen are thus compressed and air is forced out of the lungs. Now, immediately swing back slowly to remove the pressure, but leave your hands in place. Through their elasticity the patient's chest walls expand and his lungs are thus supplied with fresh air. After two seconds, swing forward again, and repeat deliberately about 15 times a minute.

Continue if necessary for at least three hours without interruption, or until natural breathing has been restored or a physician has arrived. Even after natural breathing begins, carefully watch that it continues. If it stops, start artificial respiration again.

Although the administration of oxygen is by far the most important factor in the treatment and cannot be overemphasized, other things should be done to help the patient. He should be kept quiet and lying flat, to help his weakened heart. As he gets better, he should never be allowed to walk about or in any way exert himself for there is danger of heart failure. Heat from safety lamps, hot-water bottles, or warm bricks, rubbing the arms and legs, and keeping the patient well covered with blankets all help the circulation and aid in tiding the body over a period of low vitality. The safety lamps, hot bricks, etc., should be well wrapped in cloth or paper as a precaution against burning the patient. Other stimulants, such as hypodermics of caffein-sodium benzoate or camphor in oil, may be used only by a physician, and after he has considered the possibility of over-stimulation and consequent collapse. The patient should be kept in bed for a day at least. Later he should be treated as a convalescent, being given plenty of time to rest and recuperate. Just how long this should be depends on the severity of his poisoning and should be decided by his physician.

Summary of Treatment

1. Administer oxygen as quickly as possible, and in as pure form as is obtainable, preferably from a cylinder of oxygen through an inhaler mask.
2. Remove patient from atmosphere containing carbon monoxide.
3. If breathing is feeble, at once start artificial respiration by the prone posture method.
4. Keep the victim flat, quiet, and warm.
5. Afterwards give plenty of rest.

DOMINION FOUNDRY SUPPLY COMPANY LOCATED IN THEIR NEW QUARTERS

The Dominion Foundry Supply Co., whose Toronto branch has for some years past been located on Spadina Ave., are now located in the commodious premises, formerly known as the Burg foundry on Niagara Street, near Bathurst St.

This property, which was originally the John Doty Engine Works, was later operated by the late Senator Bertram under the name of the Bertram Engine Works, and subsequently used by different concerns as an auxiliary during rush times. It was finally bought by the H. W. Petrie Co., and utilized for machinery storage. The location is ideal, as the Bathurst St. car line, connecting with the Union Station, passes the property, while the G. T. R. tracks are in the rear with a switch running the entire length of the buildings. The buildings are of substantial brick construction and include all the units required for a complete engineering plant, but only the foundry department has been taken over by the Dominion Foundry Supply Co. This consists of a building 75 ft. by 100 ft., with a yard room 25 ft. by 100 ft. partly under roof, giving 10,-000 square feet of floor space in addition to the overhead space on what was formerly charging floors, etc.

The foundry was equipped with four powerful jib cranes, as well as an electric hoist. The hoist and one of the cranes has been retained.

The two cupolas have been removed, but the brick structure which housed them is kept intact, making an ideal storage for dusty material such as sea-coal, where it can be unloaded from the railway siding without contaminating the rest of the building.

The entire floor has been concreted, and the walls white-enameled, which with bins for each brand of molding sand, core-sand, silica-sand, fire-clay, etc., and shelves partitioned off for chaplets and similarly light material, gives it the appearance of a retail store. Heavier material such as barrels of plumbago, crucibles, etc., occupy the open space on the floor, each in its proper place.

Platforms on a level with freight car floor are built outside the intake doors of the building to facilitate unloading merchandise as well as reloading for shipping to customers.

A neat office has been built with desk space for office staff and travelers, stationery room, cloak room and lavatory, shipping room, steam heating plant, and private quarters for the genial manager, Mr. Frank J. Ross.

Mr. Ross announces that he has found business much better during the last year than during 1921, but looks forward to a bumper year in 1923, otherwise these recent expenditures on improved quarters would not have been considered.

MOLDING BAND WHEEL

(Continued from page 17)

will ever be possible. The experience of many concerns that have adopted safety methods in their foundries shows, however, that it is possible to eliminate a large proportion of the commoner causes of accidents, without much expense and without any serious disturbance of existing conditions. The Engineering and Inspection Division of The Travelers' Insurance Company, in the course of its extensive experience with foundries, has given a great deal of study to this subject, and the recommendations and suggestions that it has made in the course of its practical inspection work have been well received by foundry managers, and have been particularly effective in bringing about better and safer conditions. The booklet from which this article is extracted is based upon this study and experience and contains some of the suggestions that have been found to be most serviceable and important in dealing with the accident-prevention problem in its broader phases. Every foundry has important special safety problems of its own, which must be dealt with effectively if the best results are to be obtained; but to include all features of this kind would swell this booklet to such dimensions that its effectiveness and usefulness would be impaired. We have therefore confined our attention to danger-points of wide and almost universal occurrence.

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American Methods of Malleable Iron Casting

Layout of Furnaces, Advice on Management—Data in Connection With the Finished Product—Black Heart Preferable to White Heart in American Practice

By Enrique Touceda

The following paper, prepared and delivered at the Conference of the Institution of British Foundrymen, held at Birmingham in June last, by Enrique Touceda, of Albany, N.Y., covers the entire field of malleable founding in America, which in many respects is different from the methods practised in Europe. Mr. Touceda is undoubtedly one of the most learned authorities on the subject in the world, and his experiences and research work should be carefully studied and preserved by every foundryman whether actively engaged in malleable iron work or not. Since the paper is lengthy, it will be impossible to publish it all in one issue, but the reader can be assured that it gets more interesting as it advances and each issue should be eagerly perused.—Editor.

THE author of this paper would assure you that he feels highly flattered in having received your kind invitation to prepare an exchange paper to be read before your body at this meeting, and deeply grateful as well in having been asked to appear in person as your guest. He has read with great interest and profit many of the valuable contributions written by your countrymen that have served to so greatly enrich the literature of the metallurgy and metallography of iron and steel, and he well remembers particularly during the early days of his career how profoundly he prized and was impressed by Sir Lowthian Bell's classic, "The Manufacture of Iron and Steel," which at that time he continually read and studied with indefatigable zeal and enjoyment. It served as a constant source of inspiration, and for it the author has an affection that has in no way been tempered with the passage of time. The author's one regret is that, having received so much from you, he has so little to offer in return. In the letters received from your Conference Secretary, Mr. Thomas Vickers, C. E., and the Secretary-Treasurer of the American Foundrymen's Association, Mr. C. E. Hoyt, it was requested that the subject of the Paper cover the manufacture of malleable cast iron as conducted in this country. Their suggestion was naturally prompted in large part by the knowledge that the author has had a very close association with this industry, particularly during the past ten years, and in part perhaps by sharing in the interest that has suddenly awakened in other countries in regard to this subject. During the past year inquiries pertaining to the practical details of this process have been received from France, Belgium, Italy, Australia, and Japan. The author has had the pleasure of receiving visits from a number of engineers from abroad who have seemed greatly interested in the practical rather than the metallurgical details of this industry. These facts have been entered into principally, because it is the author's thought that if he took as a guide the character of these inquiries and the various questions that have been asked him by the visitors referred to, he would not miss by much the ground that members would prefer to see covered, rather than attempt to enter into an academic discussion in regard to the mechanism of graphitisation and other controversial matters concerning which so much has been written of late, or in dwelling on other strictly metallurgical details that have been so ably covered by many others, and particularly by Mr. H. A. Schwartz, whose book, compiled from articles he has written for The Iron Trade Review, is about to be issued. The author is assuming therefore that for the most part it is the purely practical end of the proposition that will prove of greatest interest to you; that what you desire mainly is a more or less brief reference to those points concerning which inquiry has been made both in the lay-out and operation of a malleable-iron plant of average capacity, and supplement this with some other matters that in some cases have not been touched upon by others.

The Lay-out of a Malleable Plant

Starting with the lay-out of the plant, the details of which should have most serious consideration, it is obvious that its correct plan will be dependent upon the plant-capacity specified, and the shape of the building site. In connection with the latter high ground should be selected, if possible, while low ground that is naturally wet and cannot be successfully drained should be shunned as worthless, for if annealing ovens are erected in such a locality annealing difficulties will prove to be perpetual. Whether the plant is to consist of one or various working units, and even if the raw materials are to be handled by means of a crane, it is desirable that each kind be stored as near to the metallurgical apparatus in which it is to be used as is both convenient and possible. It is advisable that at the sidings where the raw materials are to be discharged, the tracks be elevated on trestles at a height and length that will admit of the rapid and cheap discharge of car contents.

In the case of the moulding, face and core-sand, a saving will result if the roof of the buildings in which they are to be stored is flush with the tracks on the trestle, in order that the cars can be discharged directly through roof openings into the buildings or sheds, which should be constructed with this end in view. Irrespective of the size of the plant, the various departments in each unit should bear such a relation to each other that the product from the very start of operations and at each step in the process should be continuously approaching the shipping room in the most direct manner possible, in order to avoid the retracing of steps. Economy in construction will result if each separate department is dimensioned strictly on the basis of providing not much room in excess of that which will occasion quite serious congestion when running at maximum capacity. Experience has convinced the author that, in rare instances only, are malleable-iron plants ever run at maximum capacity, for when business is booming labour is scarce and inefficient, and when labour is plenty and men are willing to do a fair day's work there is a dearth of business. A little crowding therefore in the various departments can be tolerated at times that prove exceptional. The one-storey straight-line plant of fair capacity (25 to 35 tons of castings per day) with core room and shipping rooms at extreme ends, and foundry, hard-iron mills, trimming room, grinding and sand-blast room, annealing room, and soft mills in between and located in the order named, will be found convenient, and can be arranged as to permit of considerable economy in construction, while admitting of considerable flexibility as to expansion. The character of building unit, very popular at the present time in the States, is the one-storey steel-skeleton type with curtain walls, brick pilasters, and concrete foundations, with either a saw-tooth roof, or one of usual construction with sufficient pitch, and 30 ft. wide, a monitor running the full length of the building with window sashes hinged at the top to swing inward, and sashes in the curtain wall pivoted at the centre, the roof covering being of slate, slag, fabricated cement-asbestos tile, or other fireproof material. The one-storey building of this type with either style roof possesses many advantages, in that maximum visibility within is assured, ventilation is facilitated, and fire risk minimized.

Ventilation

One of the most important items to be considered is that of efficient ventilation, particularly in the foundry building and core-room. Without a constant supply of fresh air, energy of body and alertness of mind are gradually deadened as the day progresses, and when activity and vigour are lowered the effect is always noticeable in increased foundry loss on late heats, while the hazard, due to accident, is augmented.

For effective ventilation dependence should not be placed wholly upon the monitor, but it should be supplemented by well-designed ventilators, positioned in such a manner that a steady discharge of air is assured. A popular and very efficient make, rotates on ball bearings—the direction and extent of rotation being controlled by a vane—with the result that the exit for used air always faces away from the wind, which in passing, creates an active suction. These ventilators, when installed by those who understand the ventilating problem, have proved to be worth many times their cost.

The efficient and uniform heating of the foundry proper is a problem replete with difficulty, owing to the variable conditions that must be met. During the night there is a natural fall in temperature, coupled with the condition brought about by wetting and cutting of the sand, that produces a clammy dampness rather hard to remove by the time the men report for work in the morning. In contrast to this condition is the state of affairs that exist after a heat, when the air is filled with hot steam and a great amount of heat is radiating from the stripped castings. Some foundries of even fair size still use the salamander, which while very cheap to install is expensive to run, takes up space of value, interferes somewhat with crane service, and occasions loss of time due to the men congregating around it if they feel slightly cold. One of the best and most approved systems is to force warm air into the building through pipes properly spaced to yield uniform heating by one of the many blower systems now on the market. Live and exhaust steam from the power house or from a separate steam source designed for heating only, or from such a plant supplemented by steam from waste-heat boilers, is used in some plants in manifolds hung in such a manner as to be out of the way but as near as practical to leakages of cold air from windows, entrances, etc., in order to heat this air as it filters into the building. The author has seen many plants where a waste-heat boiler-installation has proved to be a mistake. A waste-heat boiler has not been designed to date in such a manner that after furnace operations have ceased it can be hand-fired economically. In running but one heat per day, any saving would be offset by the huge amount of coal required to keep up steam for the balance of the time, when power or heat was required, while if the boiler is allowed to cool off and electric power and steam for heating derived from a small auxiliary heating plant substituted, the maintenance cost, due to the strains set up, would prove disastrous. The scheme works out very nicely in other cases, especially where the cost of electric power or coal is high; where two heats per day are run from the same furnace; where one boiler is used in common with two furnaces, and particularly when a great amount of power is required for sand-blasting purposes. Reference should be given to that type of boiler least affected by quick changes in temperature.

Foundry Floor

The foundry floor is another item that is deserving of some thought. Some favour the concrete floor, but the writer believes that if a vote were taken of the moulders the decision would be in favour of almost any other type. The concrete floor is unquestionably hard on the feet, and dangerous in some particulars. When spills occur an eye can be lost or serious burns sustained due to the instantaneous generation of steam from the moisture on the floor surface, which invariably is more or less wet. Serious accidents have occurred in the carrying of iron through the moulder slipping on the rounded particles of metal that have been occasioned by spills. Even when the floor has been properly laid, it subsequently can be ruined through carlessness on the part of the moulder in shaking out the castings too hot. However, the worst feature of the concrete floor is its great tendency to transmit vibration. When bumpers or vibrators are used, the probability of shaking down dirt from the cope or the cope itself is great. A floor of hard-wood blocks properly laid on a sand foundation yields better all-round service, and is equally good for the gangways or, if protected with a little packing where the pots are dumped, for the annealing room; but when used in the annealing room a strip paralleling the front of the oven and 6 ft. wide should consist of square annealed iron plate about 18 in. by 18 in., with lugs on the under side, and set in concrete, or smooth granite block, set in concrete and well grouted. Molten iron has no other effect on wood block than to produce a surface char, which defects are very shallow, and when present become filled and well protected by sand. Black-gum, maple, beech, southern yellow pine, if well creosoted, give splendid wear. The blocks should be laid in straight parallel courses, with the grain of the wood vertical, care being taken to keep straight courses and close joints. All courses should break joints alternately by a lap of at least 2 in., and filled with a hot, low-melting-point pitch of a consistency that will flow like water, to the end that all crevices will be completely filled. Against the sides of the building and around all foundations expansion joints should be made by placing a 1-in. by 4-in. tapered board on edge against the sides of the building and around foundations, which boards subsequently should be removed after the blocks are laid and rolled in order that the void can be filled with hot asphalt to within ¼ in. of the wearing surface of the floor. The dirt, or clay, foundry floor is the safest, and the one that is most popular with the moulder. It is comparatively inexpensive, and, if given proper attention, can be kept level and in excellent condition, while if a standard travelling sand-cutter is used, there will be no danger of the floor being cut, provided precaution is taken to see that the treads of the wheels are made sufficiently wide to prevent their sinking into the ground.

(To be continued.)

NEW SAND BLAST BARREL

The utility of the Barrel Sand-Blast for cleaning work adaptable to this method of handling and its economy through the work being cleaned in bulk makes improvements in this character of equipment of interest to the majority of Sand-Blast users.

A new barrel just introduced by the Pangborn Corporation of Hagerstown, Md., embodies features that have taken into consideration economy of operating cost, from the viewpoint of both increased efficiency of blasting action and durability of the equipment itself.

Experience has shown that cleaning capacity in Sand-Blasting is governed by the distance of the nozzle from, and its angle to, the work. To accommodate varying classes of work with the changing sizes of the individual pieces and the corresponding "ride" within the barrel drum, the nozzles are made adjustable in both horizontal and vertical positions to secure the most effective position.

A mechanical separator assuring constant and perfect separation of the abrasive for re-use is obtained by a ribbed roller driving against a shaft protected by heavy rubber tubing. This tubing takes the entire wear and is quickly and cheaply replaced.

Long life for the equipment is provided in every moving member. The Barrel Drum is reinforced at the door opening with plates and angles inside and outside; steel tires pinned to head castings and driving on manganese steel rollers, with front rollers idle and equipped with roller bearings, provide smooth even traction with little wear.

Driving sprockets are steel and with chain in oil bath, all encased dust tight.

The clutch is simple and positive acting, will not get out of adjustment but insures satisfactory service at all times.

Two sizes with drums 30 x 40 and 50 x 40 make it available for work from small to as large as is feasible for barrel cleaning.

Bright Machine Shop, but Dark Gloomy Foundry

Contrast This Room After Being Enameled With What it Was Before—Foundries Which Are More Susceptible to Smoke and Dust Would Make a Greater Contrast

By F. H. BELL

IN THE illustration will be seen what I will call a "before and after" view of a small section of the machine shop department of one of Canada's leading manufacturing plants.

This machine shop has recently been given a good interior coating of white enamel.

To the left is shown how it appeared before being enamelled, while to the right is the same section after the enamelling had been completed.

It is not my intention to go into details in comparing a machine shop with a foundry any more than to explain that while a machine shop requires all the light it can get, it does not need it any more than the foundry does and in addition to this it does not have the same chance to become dirty.

While a machine shop has not much to dirty it a look at the two views will convince the observer that a machine shop can look almost as dingy as a foundry but it is not noticeable until compared with itself in a garb of white.

As I have already mentioned, this is a portion of one our best industries. Standing between it and the foundry is the workmen's entrance. Those who are employed in the machine shop turn to the left, while those who work in the foundry turn to the right. Imagine the feelings of the foundry staff when they happen to look to the left on entering and know that they must turn to the right and walk into the gloomy precincts of what is always the gloomiest part of any manufacturing concern—the foundry

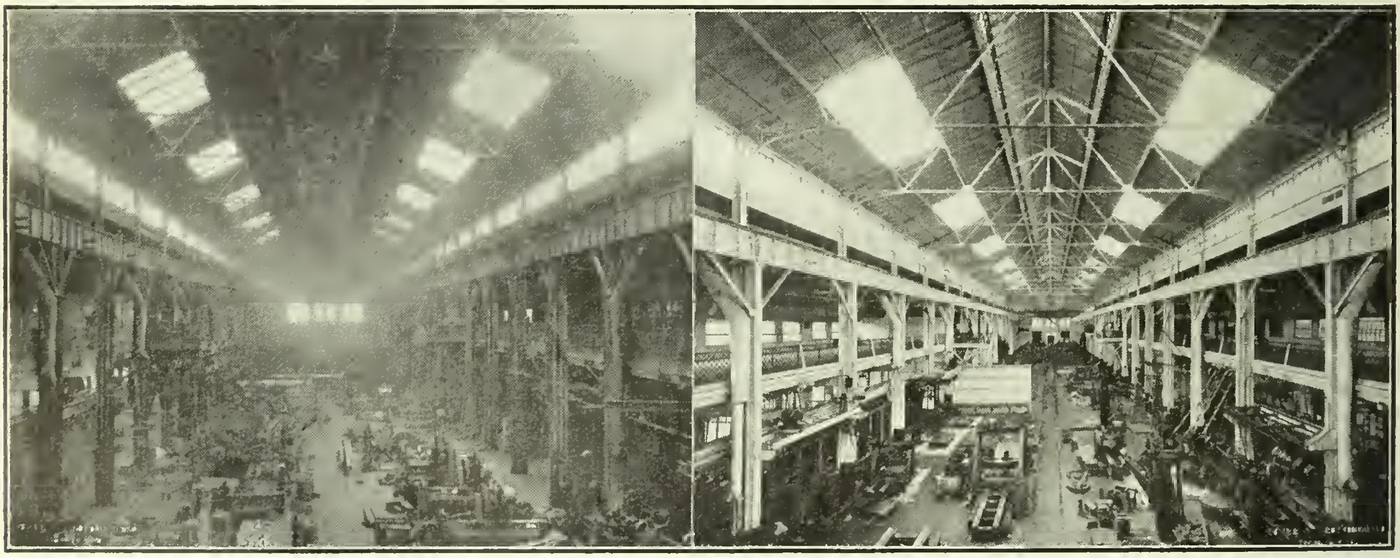
Like the machine shop just shown, the foundry department of this establishment is one of the most modern in Canada but, while it has all the latest devices for doing high-class work, and while it, like all foundries, has a continuous deluge of smoke and dust to contend with, nothing is done to prevent this from blackening the walls and other interior parts.

This plant is not selected because of any particular oversight on the part of the management towards the men in the shop, but because they thought first of the machine shop. They intend to do the foundry in the near future, but the foundry as is usually the case is of secondary consideration. How any organization could endure the eyestrain of being compelled to witness any ordinary every-day foundry after seeing a machine shop such as this would be hard to explain.

In the last few issues of this publication I have pointed out a number of Canadian foundries which have been enamelled in white and I am aware of others which will be, and, as I have mentioned in one of my former articles, this is one of the most advanced strides in foundry practice during the present century. The foundry was always recognized as the dirtiest place on earth for a workman to be employed in, and molders have always been considered as the most dissatisfied bunch of any in the industrial field. I spent many dreary years in the foundry and was as big a grouch as any of them, always corroborating the arguments of the molders, that they had the most tiresome as well as dirtiest trade of any. I am not backing down on this yet as I still think that molding is the hardest work of any of the occupations which go by the name of "a trade," and while I will aways back up this contention I am convinced that much of this could be remedied by improving the surroundings.

I have spent a lot of my time in institutions where I had to begin at one end of the plant and walk through the entire works from the machine shop which was invariably in the front, right through until I "fetched up" at the foundry which was invariably in the neighborhood of the back fence, where I would settle down for the day. No matter how tough looking the machine shop happened to be it would be the best of all, and the other departments would keep looking worse until the climax was reached in the foundry. This always grated on my nerves but it did not give me such a jolt as I would get when employed right next to the machine shop and I would have to step right out of one into the other, and where the contrast would be as great as the "before" and "after" views here shown. There is no reason to keep the foundry in such condition any more than there is to keep the machine shop this way, but it is just a habit which was allowed to form. This state of affairs is now be-

(Continued on page 29)



Before and after view of one of Canada's leading machine shops. The white enameled coating makes the difference. This difference in appearance would be greater in the foundry.

Oxy-Acetylene Welding Saves Valuable Kettles

By Covering Tightly With Asbestos Paper to Retain the Heat, Burned and Cracked Kettles Were Successfully Repaired, Saving Thousands of Dollars

OXY-ACETYLENE serves a grand purpose in out-of-the-way places such as mining districts, and may save thousands of dollars that would otherwise be lost. From a foundry standpoint it might be looked upon as a competitor, but circumstances alter cases and in the case of the cracked pot, shown in the illustration, the odds are in favor of oxy-acetylene. These pots are cast iron and weigh about eight tons each. They are used in lead refining or smelting, but this class of work is usually done in a locality far remote from the foundry where the pots are made, thus adding the freight charges which are heavy, to the price of the casting, making it unusually expensive, and when cracked the pot is practically valueless, as the work of smashing it and delivering it to the nearest foundry would cost all that the scrap metal would bring. "Oxy-Acetylene Tips" in its Sept. issue describes one instance where considerable money was saved, and this instance is probably only one of many similar and dissimilar cases. Following is the story:—Some months before the first symptoms of the after-the-war slump in the metal mining and smelting industry appeared, the Bunker Hill and Sullivan Mining and Concentrating Company of Kellogg, Idaho, made several unsuccessful attempts to weld broken and cracked cast-iron "lead pots." These pots, each weighing approximately eight tons, had been retired from use after damage sustained from expansion and contraction strains. There were twenty-six of them, representing a replacement value of more than $30 000, as against a scrap value of possibly a few hundred dollars, after deducting what it would cost to transport them to a market.

The company's welders were not unfamiliar with heavy work, but after trying both electric and gas welding without success they concluded that the high temperatures required in smelting had destroyed the original welding properties of the metal. It was known that the intense heat had altered the character of the original metal by burning out practically all of the carbon. This made it not unlike furnace grate bars after long service, a condition that later received particular attention when a service man demonstrated the procedure necessary for successfully welding the pots.

This occurred at a time when it seemed that the only possible way of saving anything out of the mass of material was to dispose of it in the form of scrap. An oxy-acetylene sales engineer, of Seattle, opportunely appeared on the scene and volunteered the assistance of his company's service operators to demonstrate how the pots could be reclaimed. The offer was accepted, not without some skepticism, and a few days later preparations were made for welding the first pot. Some experimenting was necessary before adequate pre-heat was provided. In the first attempt an improvised furnace was built about the part to be welded and twenty-six sacks of charcoal were fired at one time without much more than warming the big shell. Before the preheat could be brought to the point for welding it was found necessary to supplement the charcoal fuel with oil blast which was afforded by means of a compressed air line connected with a nearby power station. In addition to this, the casting was completely covered with asbestos paper which was later opened only sufficiently to admit of the welding operation, following which the pot was again covered and allowed to cool very slowly so as to gradually anneal the entire casting.

After this demonstration the Bunker Hill and Sullivan welders had no difficulty in reclaiming the other pots. As a result of the service the mine and smelter people bought additional oxy-acetylene apparatus, and reports of the big job resulted in the purchase of equipment and the carrying out of similar work by other smelting plants in the Pacific Northwest. Published accounts of the reclamation elicited inquiries in instances as remote as Great Britain and Spain.

In this connection it is of more than ordinary interest that the Bunker Hill and Sullivan people have continued to employ this process and that the company has completed only recently an important salvage program of like character.

At first blush it might be thought that the illustration cited as service given in a special case where the need was not known to the user, but was pointed out to him, is scarcely fitting. Such an impression would be erroneous, however, because of the fact that the company's own efforts had proved futile and possibility of effecting the desired repairs had been definitely abandoned as impracticable. Thus, while the need may have been felt, it was not known as an attainable thing and had to be pointed out in the manner described.

TAKE FREQUENT INVENTORIES

Inventory not only your business but yourself as well. Make a list of all your faults and virtues, of all your assets and liabilities of character, just as you catalogue the assets and liabilities of the business. It's not the business, but the men back of the business, that determine the success. The inventories that do not include these men are incomplete. The results have been analyzed, but not the causes. Get back to the causes. Inventory these, and take your inventories frequently.

Eight-ton kettle which cracked from continuous expansion and contraction. Ordinarily it would have been scrapped. Oxy-acetylene saved it.

Modern Methods in Foundry Fettling Shop

The Connecting Link Between the Foundry and the Machine Shop is an Important Department, But is Not Always Treated as Such—Modern Ideas Suggested

By Major F. Johnstone-Taylor, Shrewsbury, England.

This interesting article from an English contributor appertains to British foundry practice, but is equally applicable to Canada or any other country. What is known in England as the fettling shop is commonly known in Canada as the scratch room, but is, in most cases, unworthy of any name. It is certainly the one department of the foundry which, in Canada as well as in Great Britain, has been pretty well overlooked by efficiency engineers and scientific managers, until very recently. Health boards have been doing good work, but the difficulty in securing men to work in the fettling shops has probably been the greatest factor in causing this department to be considered when designing foundries. The industrial engineers who are at the disposal of the foundrymen nowadays are awake to the necessity of improving this much-neglected room, but there are hundreds of foundries already in operation which can be greatly benefited by adopting the methods herewith advocated.—Editor.

Of all the departments of a modern engineering plant perhaps the fettling department of the foundry is the one which is run on the most haphazard lines. There is really no reason for this. It is a case of the old principle of what is worth doing at all is worth doing well, and this principle may as well be applied to the fettling shop once for all if any foundry is to be run on modern lines. It is a moot question of course whether so called scientific management with its army of clerks, its array of card indexes, forms, etc., and its general attempt to run the details of the whole works from a central office is of anything like the value its exponents claim it to be. It certainly can be said that such methods have little value in connection with the fettling shop. On the other hand the efficiency thereof can be vastly increased by careful organization of the work and the introduction of a few labour-saving appliances.

Layout

The layout of a fettling shop should be done with care, the heavy castings should be brought into one bay, and the light ones into another, all the castings being sent out through the latter. Ample overhead cranes should be provided for heavy work, and the jib cranes on the walls or columns should cover as much of the floor as possible and be used for dealing with the lighter work, while runways in the light bay are useful. Pits covered with perforated steel floor plates with hoppers underneath connected to an exhaust fan is a good means of dealing with dust during the coring of castings. The castings could be placed on these perforated floors permitting of all the sand and dust to be drawn downwards away from the worker into a closed chamber near the sand shed. The light dust would be drawn through the exhauster, and deposited in a water tank. A floor of this description would measure say 12 feet by 9 feet, would require a 2,500 cubic foot exhauster which could be driven by a 5 h.p. motor. The sand off the castings would be taken away automatically and the wheeling of the sand away would be dispensed with. If the work was carried out on benches, these could have perforated tops with hoppers underneath connected to the exhauster. In the case of iron castings after the risers have been knocked off, a casting would pass to the sandblast room where any sand remaining, after the knocking out process, would be removed. Where there is no sand blast the casting must be cleaned by either tumbling, hand scraping, brushing, grinding or pickling. Pickling is now not much used, the process is slow, the fumes from the acid are injurious to the workers, and although pickled castings machine up well, the acid is liable to damage the metal.

Rumbling

Usually small castings up to half a hundredweight are cleaned in bulk in a revolving barrel. With this method the castings are packed together with odd pieces of metal (stars) a process which removes the sand on the outside of the castings and gives it a dull glazed finish. Care must be taken of course, that frail castings do not get broken, it being usual to grade the light and heavy work, and rumble them separately. Rumbling at the best is a slow process and may damage castings, but the machine being simple it is a favourite method of cleaning. Some barrels run partly immersed in water which is heated by steam, the result being that it forms more or less of a mud bath, and it is a useful method for some classes of work as the castings dry very rapidly after the process. Rumbling, however, is much better done in a shot blast barrel. This type of barrel revolves very slowly, about four revolutions per minute, light and heavy work can be dealt with together and there is little risk of breakage. The barrel is perforated, and revolves in a closed chamber with a hopper beneath connected to an exhauster, which draws away all the sand and abrasive. The shape of the barrel is circular with a removable segment to act as a charging door, and attached to the inside of it are a series of longitudinal bars, the purpose of which is to cause the castings to tumble over slowly. No "stars" are used but blast jets at the ends of the barrel are arranged to guide the abrasive against the castings. This process is much more rapid than ordinary rumbling. The abrasive can be used over and over again after being separated from the sand and dust. Small delicate or intricate castings are better cleaned in a closed chamber, the operator holding the casting in one hand and directing the jet with the other. The abrasive used is generally chilled iron shot varying in size from 1/20 of an inch to dust. Some founders use crushed shot of a larger size; it is useful for dealing with steel castings but it is very destructive to iron. Abrasive must not be allowed to get damp, otherwise it will cake and clog the apparatus, and dry air is essential. Cooling the air to condense the steam before it enters the receiver from the compressor will ensure dry air. Sharp sand cuts quicker than shot and is often used for soft metals and for cleaning castings in the open. It produces, however, a large amount of dust, and to separate this dust from the useful sand is a difficult process requiring special apparatus.

Sand Blasting Plants

Sand blast rooms are best built up of cast iron plates with a metal roof. Electric lighting is of course essential, care being taken to prevent the shot from hitting the bulbs, the pit under the room should be about six feet deep and of any convenient size. The modern apparatus for this purpose consists of a settling or cyclone chamber connected to the exhauster into which the sand and abrasive is drawn from the hoppers beneath the room, the very light dust going direct to the exhauster. The heavier material collects in a conical hopper at the bottom of the cyclone chamber and falls through a grading tunnel, where the remaining sand is separated from the shot. The shot then falls into the sand distributing chamber which is below the cyclone operator; this distributing chamber is divided into three compartments, the top one collecting the shot after it has been separated from the sand. It then passes through a hand operated valve into the centre compartment. A valve arranged in the bottom of the latter regulates the flow of shot to the mixing tube where it falls into the stream of compressed air and is driven to the blast jet; the exhauster should be capable of removing the air in the room three times per minute so that the operator's view is not obscured by sand and dust removed by the blast. The shot is conveyed from the apparatus to the blast nozzle through rubber tubing which being flexible permits the operator to direct the blast on to any part of the casting within his range of vision. With this system the blast can be directed on any portion of the work which facilitates the removal of hard patches of sand. The operator wears a leather helmet which is supplied with clean air under slight pressure after being filtered. The nozzles used vary from ½ in. to ⅞ in. in bore, ⅝ in. being generally used, although for work having long narrow surfaces a smaller one is preferable. A ⅝ in. nozzle will clean 12 sq. ft. of cast iron surface per minute, if the scale is of an average character and it will use about 200 cubic feet of free air per minute at an average pressure of 20 lbs. The character of sand on castings of course varies considerably and the average output of a machine of this description must be determined by trial. There are of course many designs of sand blasts which permit the operator to stand outside the blast room and direct operations, but they do not permit of the work being done with such rapidity or as satisfactorily as when the operator is inside the room and directs the jet on the work as required by the varying nature of the scale. If the operator wears a proper helmet he can work comfortably for several hours in a sand blast room.

Air Pressure

The most popular plant used in England requires comparatively low air pressure, this being Tilghman's patent sandblast. In this arrangement the abrasive is fed direct into the air main and so obtains a high velocity with low pressure and small consumption of power. As stated about 20 lbs. is about the average pressure required for dealing with iron castings and about 30 lbs. for steel castings. Beyond these pressures the blast pipe becomes difficult to control; it might endanger the operator if the nozzle choked. It is usual to instal an independent compressor for this purpose.

Dressing Castings

Cast iron can easily be dressed by hand and pneumatic tools are not altogether favoured by the workers. The latter are, however, very effective on steel castings, hand chipping on which is very laborious. The risers and gates on steel castings are usually large and circular saws must be installed for this work. They are a heavy item of expense in a steel foundry. With the improved abrasives now used for wheels, grinding is economical and the fins and gates on small castings up to half a hundred-weight can be well removed by bench or floor grinders. Machines for this purpose require to be of heavy design and well bolted down so as to avoid vibration which causes hammering and subsequent wearing of the wheel out of truth. The average rim speed of such wheels should be about 4,500 feet per minute, if the wheels run slow excessive wear takes place and the metal is removed slower. For heavy work which cannot be handled at the floor or bench a swinging grinder is often used. The wheel is carried in a swinging frame and brought over the work as it lies on the floor. It is arranged to work at any angle and is hand controlled, they are usually electrically driven The various grades of suitable abrasives can usually be obtained from the makers' lists, but experience is really the only way of definitely deciding upon the best wheel for any particular job. It is important that all grinding wheels should be strongly guarded and be carefully mounted, because the bursting of a wheel, which is not an infrequent occurrence, might seriously injure the operator.

Working Conditions

There is no doubt that work in a fettling shop is distinctly laborious and arduous for the worker and anything that can be done to render it less so will represent money well spent. The dust chiefly comes from the sand cores, these having been subject to considerable heat, powdered up into fine dust when removed which is rendered more unpleasant still by the reason that it is hot. As far as British practice is concerned the government regulations are pretty stringent, and the conditions in fettling shop are undergoing improvement. Foundry dust contains no injurious germs but it irritates the respiratory organs and renders them specially liable to pulmonary diseases. In several of the smaller iron and steel foundries the most elementary provisions for dealing with dust are lacking, which to say the least is a very short sighted policy on the part of the owners.

Fettling shop operators may be rough men but they are none the less human for being rough, and the installation of labour-saving appliances and apparatus for ensuring reasonable comfort of the workers will reflect on any foresighted employer of such labour in an increased production, better work, and a general atmosphere of contented co-operation between master and man.

BRIGHT MACHINE SHOP

(Continued from page 26)

ginning to be changed as it has been learned that it is financially profitable to have things otherwise.

While I am enthusiastic over everything in the way of improvements I am, first of all, in favor of putting the shop in order; have it properly heated and ventilated; keep it clean; and have the walls snow white. Heating and ventilating have been discussed through these columns on several occasions, so has keeping the shop clean but the enamelling of the walls is more modern and will require more discussion before it is realized and understood. Whitewashing the walls right over the top of the dirt has been common practice in about one per cent. of the foundries for generations. This usually occurred once a year, the whitewash being a liquid composed of lime and water, while a whitewash brush was used to apply it. This would brighten up the place and make it smell sweet for a few days, but it would soon be as dirty as ever because lime seems to attract dirt to it and holds it fast when once secured. If a hose or a broom is applied the lime will let go of the brick wall before it will let go of the dirt, so all things considered whitewashing with lime and water was not much of a success and was not very generally practised.

White Enamel

White enamel is just as white as lime; is smooth and hard on the surface, and will stand to be washed if necessary but this is seldom called for as any little bit of dust which settles anywhere can be blown off with air. The method of applying the enamel is by means of what is called a gun. This is in reality a sort of syringe and can be rented or borrowed from the house which supplies the enamel. The operator of the gun just stands on the floor or any convenient place and squirts the enamel against the wall where it flows around leaving a glassy surface. Its advantages are that it reflects the light instead of the darkness down into the molds and keeps the entire shop like real daylight all the time. Once applied it is permanent and does not require to be redone every stocktaking week. These are two of its qualifications, the third one which seems to be of little concern to the average foundry owner but which is really the most important and profitable of the lot is that it makes the shop look fit to work in and makes for more contented workmen. Medical science proves that a man's nerves are the most easily exhausted of any part of his system and that dyspepsia, grouch, etc., are the direct results of nervous exhaustion. It also proves that when a man's mind can be kept cheerful his nerves do not go back on him. Keep him in cheerful surroundings and he will be cheerful and his work will run along at a much more profitable rate while he will not realize it himself and he will not go home as tired at night as he does. After spending thirty odd years in the foundry I am prepared to admit that the average molder can do his share of grumbling, and that I was no exception but if I had it to do over again. I would do more grumbling as there is no excuse for keeping the foundry in any less decent condition than any other part of the plant. Smoke and dust we must have, but proper ventilation eliminates part of the resultant trouble while enamelling the interior of the foundry does the rest.

PLATING AND POLISHING DEPARTMENT

Practical Articles, Useful Data, Description of Machinery, Equipment, etc., Used in Plating and Polishing Industry—Questions Cheerfully Answered

By WALTER S. BARROWS

QUESTIONS AND ANSWERS

Question:—We have several nickel anodes which have been hanging in a plating tank during plating operations for over three months and show no indication of softening. The surface remains smooth and hard. We placed one of them in sulphuric acid over-night with no effect. Dilute Hydrochloric acid did not affect the surface during eight hours soaking. We will gratefully acknowledge our obligation to you if you can advise us of a method which will enable us to use the anodes in ordinary nickel plating practice.

Answer:—The hard skin which undoubtedly covers the nickel anodes you refer to will not readily disintegrate in an ordinary double sulphate nickel solution operated with the low voltage usually employed on this type of solution. Carefully inspect all connections of your tank, taking special notice of the contact between tank rod and the hooks of the hard-surfaced anodes; if then you are satisfied that the anodes all have proper connection there is but one practical method known to us which may be employed. Grind the anode surface lightly with an abrasive wheel of medium coarse grain to remove merely the outer crust, replace the anodes in the plating tank and within a few days the surface should become slightly attacked, and film of graphitic material may be detected by rubbing with the fingers. No further trouble should be experienced with respect to disintegration. Usually nickel anodes possessing the insoluble coating also have a very coarse spelter-like grain and are not of much real service in a nickel bath. The percentage of waste is usually exceedingly high and is in the form of sharp metallic grains found at the bottom of the tank. If convenient, it would be advisable to return the anodes to the makers and obtain new anodes in exchange.

Question:—When will a nickel solution permit burned plating more easily, when in need of nickel or when there is an excess of nickel in the bath?

Answer:—A nickel solution of low metal content is productive of burned deposits more readily than a solution rich in metal. Very concentrated nickel solutions often yield deposits which crack as a result of excess current but do not burn or discolor.

Question:—I am plating short steel wires which have a thread on each end; wires are suspended in the tank in perpendicular position and quite close together, they receive a copper strike after being electro-cleaned during preparatory process. Some weeks ago I noticed that each wire had a fine sharp burr on lower end only, this condition has gradually become worse and at present a knob forms on the lower end of each wire during electro deposition period. The knob is hard and a dirty greyish-black color; it is not smooth, but rough and with sharp edge at upper portion. I have repeatedly made additions to the copper solution in order to prevent the trouble, but find that the knob forms on wires which have not been copper plated. The nickel solution registers 9 degrees on hydrometer, normal temperature is 72 degrees Fahr. It is slightly acid to litmus and is in almost constant use; anodes consist of about 90 per cent. new anodes and 10 per cent. old anode ends and pieces. This is worrying me, I shall be greatly obliged to you if you will inform me of correct procedure to adopt to prevent the burr or knob forming.

Answer:—The actual cause of the burr forming on the lower end of the wires is dirt in the form of carbon at the botton of the nickel tank. The ten per cent. of old anodes has evidently been entirely consumed and merely "rags" remain. These "rags" or light flaky pieces of anodes refuse will float or remain more or less suspended in the solution. Unless the solution is decidedly acid they refuse to go to the bottom of the tank and stay there, instead they wander about the lower strata of solution and the electric current attracts very fine particles from the pieces and fastens them very firmly on the lower circumference of the wire. These mere specks of matter are really quite soft, but they receive a coating of nickel as they come into contact with the wire and presently a hard mass of sharp pointed nickel plated specks of carbon forms the burr. The proper thing to do is remove the dirt. The greater portion of it can be taken out without removing the solution. To make a good job, remove everything from tank, clean solution, anodes, tank, etc., and no further trouble will occur unless solution requires acid. Do not blame the difficulty on the anodes, as only well-cast anodes will wear away in this manner. Give the old anodes which you have in use more frequent attention and you may prevent even more serious conditions arising.

Question:—May I request the publication of a formula for producing a brown color on sheet brass stampings? Would prefer a solution capable of giving a variety of brown tones.

Answer:—In a container suitable for hot solution mix four ounces of caustic soda and one-half ounce of yellow antimony sulphurette (sometimes called golden sulphurette) to each gallon of water required for your purpose. In a separate container dissolve eight ounces of copper sulphate. To oxidize the brass, clean as thoroughly as for electroplating. Immerse in the hot antimony solution momentarily and expose to the air, repeat the immersions and exposure to air a few times, during which operation observe the deepening shade of brown in formation. To obtain darker brown shade of rich tones, rinse from antimony solution and immerse in the copper sulphate solution which is employed cold. By quickly alternating these dips, with thorough rinse each time, the brown shade will gradually become darker. The color can be stopped at any desired shade as the changes take place slowly. This brown relieves easily and may be used on highly decorative work. Is excellent for bronze stove trimmings, name plates, medallions, etc., and harmonizes well with yellow brass.

Question:—I wish to tin plate small iron castings in a revolving plating machine; the castings are given a very smooth finish by tumbling operations and should have good appearance when plated. I may be required to use some solution for wire pins.

Answer:—Prepare a solution as follows: Dissolve 12 oz. caustic potash, for each gallon of water required to make a bath of the volume you desire, then add 1 oz. tin chloride and 1 oz. potassium bitartrate and ½ oz. sodium cyanide for each gallon of solution, stir well when all the chemicals are dissolved and heat

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Students' Course on Brass Foundry Practice

Aluminum, its Effect on Copper Mixtures, Brass Forging, Zinc and Aluminum, Aluminum Forging, Magnesium, its Effect on Aluminum—Queer Chemical Changes From Slight Change in Formulae

By F. H. BELL

IN OUR last lesson we learned that aluminum must not be included in the formula for castings which are to stand pressure. This is one of the queer features in chemistry. The aluminum seems to shrink away from the other metals, leaving pores which cannot be seen with the naked eye, but which will show when the casting is put to the test of water or steam pressure.

This class of alloy, however, makes ideal material for brass forging, which is becoming popular of late. Brass forging is simply a process by which the brass is heated to almost the melting point, when it assumes a consistency similar to rubber. In this state it is put into steel dies and pressed or squeezed to the shape of the die. By learning the exact weight required, a blank casting, although considerably dissimilar from the desired shape, can be forced into quite complicated designs, which would be difficult to mold or cast in the foundry and which require no machining.

As I have said, if the metal is porous, through using aluminum, the pressing will close all of this, leaving a perfectly sound air-tight job. This being the case, those engaged in brass forging use aluminum in their mixtures, as it has beneficial qualities not easily arrived at by any other means.

Pure aluminum, although a soft, pliable metal, adds greatly to the tensile strength of the commonly-used mixtures if used in the proper proportions. Another remarkable characteristic, or rather series of characteristics, of the two metals, copper and aluminum, is that a small amount of either one hardens the other, while adding to its tensile strength and elongation. If copper and aluminum, both comparatively soft metals, are mixed in equal proportions, the result will be a brittle, grayish-white alloy of practically no use for any purpose. In fact, we can stray a long way from this proportion and have equally as useless a mixture, as for instance, 80 per cent. of either one mixed with 20 per cent. of the other makes a brittle, useless substance. Experience has taught that about ten per cent. of the alloying metal is all that can be usefully employed, although as high as fifteen per cent. copper has been used to advantage in some kinds of work such as, for instance, is required to stand a high temperature. Experimenting with all the different proportions has demonstrated that 8 lbs. of copper to 92 lbs. of aluminum makes the best general-purpose alloy. If carefully melted and mixed, it will produce an alloy with a tensile strength of 20,000 pounds to the square inch, which casts well and gives little trouble from shrinking, with its consequent drawing and checking. This is commonly known as No. 12 alloy and is the one most generally used for making aluminum castings.

Now if we take the other limit—that of alloying a small amount of aluminum with copper—as we add the aluminum we add to the strength as well as to the hardness of the copper, up to ten per cent., after which the result changes almost instantly into the brittle material spoken of.

If we stop at the ten of aluminum to ninety of copper, we have what is known as aluminum bronze, which has a tensile strength of 110,000 pounds to the square inch. This bronze is ideal for making gearing, as it is at once strong and hard, two characteristics which are difficult to combine in the same casting, and both of which are essential in resisting the shock as well as the wear to which gearing is subjected.

Zinc and Aluminum

Zinc can be alloyed with aluminum to good advantage for certain kinds of work. In fact, the Germans, when pressed for material, were forced to experiment with this metal, with the result that they proved it to have advantages hitherto unknown. But circumstances alter cases, and zinc might not always be used in the cases where the Germans were forced to use it. Zinc added to aluminum increases its tensile strength while reducing its ductility which is to say that where it has to withstand a straight pull, its strength will be increased, but zinc, which is a fairly hard metal itself, hardens the aluminum in proportion to the amount used, and, naturally, decreases its ability to resist shock or bending stress. Zinc, unlike tin, just hardens soft metals to what might be termed the "mean" hardness of the two, but if properly proportioned adds greatly to the strength of the commonly-used non-ferrous metals. If zinc and aluminum are mixed in equal proportions and melted at a temperature which is not sufficiently high to volatilize any of the zinc, the tensile strength of the resultant casting will be approximately 40,000 pounds to the square inch. This alloy, although strong to resist straight pull, is very brittle and will not stand the least shock. Twenty-five per cent. zinc is probably as high as could be of any real use, while from ten to fifteen per cent. is more common. This alloy could be used in the forge process just described. Zinc has a lot of good points, but one point which is good on some occasions is a drawback on others, viz., it will not stand heat. If an aluminum-zinc alloy containing 25 per cent. zinc is immersed in boiling water, it will be decreased in tensile strength to about half what it was.

Aluminum-Zinc-Copper

While aluminum alloys mix readily with either zinc or copper, it is really better to use both zinc and copper. If three per cent. of copper is added to the zinc-aluminum alloy just described, it makes it more rigid, gives it a better face, and is, of course, stronger.

Tin

Tin seems to be a hardener wherever used, and if one pound of tin is added to ninety-nine pounds of aluminum it will make almost as hard a casting as ten per cent. of zinc will do, but it does not add to its tensile strength as copper and zinc will do, which is the real object in adding any alloy, although aluminum without an alloy is too soft to be of any general use, even where strength is not a requisite.

Aluminum is a metal which was unknown one hundred years ago, and, after its discovery in 1828, it was so difficult to produce that it was only used in a very small way up to about the beginning of the present century. Now it has been demonstrated that about one-seventh of the world's crust is aluminum, which is far in excess of the iron content, which was formerly considered as the most plentiful metal. It is one of the lightest of the metals, which makes it a valuable asset to the engineering world, particularly since the foundryman has learned how to harden and strengthen it—two important characteristics which it lacks in its pure state.

Magnesium

Magnesium is a metal which has been found to alloy well with aluminum, giving some results not otherwise obtained. This metal has been known for many years, but its usefulness in the foundry has only recently been realized. It burns so easily that it has been used in making lights and in fireworks, etc., but not to any extent in ordinary foundry

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Production of Iron, Steel and Ferrous Alloys

Always Big Importers, Canadians Imported More Than Their Share During the Past Year, But Canadian Furnaces Are Resuming Operations—Will Soon be Back to Normal

PIG iron production in Canada, which dates back to the time of the early French colonists, has always had a more or less checkered career, but never to a greater extent than during the year which has just drawn to a close. The coal miners' strikes and the railway troubles, all reflected directly on the production of pig iron. So great was its effect that many of the furnaces were forced to cease operations entirely, while the price which was necessarily asked for the output of those which operated was such as to encourage the importation of English and Scotch iron, thus making the tonnage from the Canadian furnaces show more unsatisfactorily from month to month, just when industry was actually making better showings each month. Foundry business while not up to normal during 1922 was in excess of 1921 but a poorer showing from our furnaces is reported. The government reports are not by any means encouraging although as pointed out they do not reflect conditions in the foundry business. They do point out that there is room for careful study on how to correct the mistakes which are making such reports possible. The production of iron, steel and ferro-alloys in Canada during the first nine months of the year, according to the report of the Dominion statistician, 1922, was more depressing than it was interesting, although when the cause is considered it puts it in a more understandable light. September was the worst month in the year, but October showed a marked improvement, which has continued in November and will undoubtedly continue right on through the coming year. A comparison between the Sept. and Oct. reports will be interesting.

September Production

The production of pig iron in September declined 7.92 per cent from the output of the previous month, the respective tonnages being 27,123 long tons in August as compared with 24,974 tons in the month under review. The production was also less than that of September last year by 40.8 per cent. A comparison of the cumulative production during the first nine months of 1922 with that of the corresponding period last year shows a decrease from 457,157 tons to 275,989 tons or 39.6 per cent.

One furnace was blown in at Hamilton and another at Sydney, while one of the furnaces at Sault Ste. Marie was banked. At the end of the month, then, the active furnaces numbered two at Sydney, one at Hamilton and one at Sault Ste. Marie, a net gain of one furnace over the previous month.

Another development was the slight increase in the several grades of iron produced for sale. The production of basic pig iron increased from 6,557 tons in August to 7,991 tons or 21.5 per cent. The September production intended for this purpose was also higher than in September of last year by 58.14 per cent. The foundry pig iron produced for sale increased from 6,296 tons in August to 6,985 tons in September. The output of malleable iron for sale also rose from 281 tons in August to 1,096 tons in the month under review.

The production of ferro-alloys dropped slightly from 1,864 tons in August to 1,832 tons in the following month. The cumulative production during the first nine months of 1922 was 15,178 tons as compared with 18,698 tons during the corresponding period of the previous year.

October Production

The production of pig iron in Canada during October showed an increase of 11,914 gross tons or 47.7% over the record for September, and amounted to 36,888 tons as compared with 24,974 tons in the previous month. The increased tonnage was almost wholly basic pig iron manufactured for use by the firms reporting. The production of this grade increased from 16,976 tons in September to 28,922 tons in October or 70.4%.

Although the October production showed an encouraging increase and was the greatest since March of this year when an output of 41,733 tons was reached, it was still below the monthly average for 1921.

During the ten months ending October, the average monthly production of pig iron was 31.287 tons this year as compared with a monthly average of 50,673 tons in the same period last year. The cumulative output was, correspondingly, 312,877 tons in the past ten months as against 506 730 tons in the first ten months of 1921.

The number of active furnaces at the end of October was unchanged at four, viz: one at Sault Ste. Marie, one at Hamilton and two at Sydney.

The production of ferro-alloys remained practically the same as in September at 1,823 tons comprised wholly of ferro-silicon of 15 to 80% grades. Of this amount 68.6% was of 15% ferro-silicon.

Steel Ingots and Castings

The production of steel in September declined by 23,373 long tons from the output of 59,160 tons in August to 35,787 tons in the month under review. The cumulative output during the first nine months of 1921 was 477,588 tons as compared with a production of 334,835 tons in the corresponding period of the present year. The closing of the steel plant at Sault Ste. Marie accounted in large measure for the decrease in production during September.

The output of basic open hearth ingots for further use declined from 56,997 tons in August to 33,815 tons in September, a decrease of 23 182 tons or 40.7 per cent. A small quantity of electric steel ingots for further use amounting to 124 tons was reported for September while none was made for direct sale.

The total production of ingots was less than the output of the corresponding month of last year by 20,540 tons or 37.7 per cent. The production in the first nine months of 1922 was 319,943 tons while that of the corresponding period of the previous year was 459,960 tons representing a decrease of 30.4 per cent. The production of steel castings also suffered a decline. The total output in August was 2,204 tons, which decreased to 1,848 tons in the month under review. The decline amounted to 356 tons or 16.15 per cent. An opposing tendency developed in connection with basic open hearth castings of which the production increased from 208 tons to 837 tons. On the other hand the output of Bessemer and electric grades declined considerably.

Steel Ingots and Castings in October

The output of steel ingots and castings in Canada during October amounted to 52,735 gross tons, an increase of 47.3% over the September production of 35.787 tons. Basic open hearth ingots produced for further use by the firms reporting amounted to 50,851 tons in October as compared with 33,815 tons in September, an increase of 50.4%. The average monthly output of basic open hearth ingots during 1921 was 53,489 tons and for the first ten months of the current year averaged 37,052 tons. The month of October therefore showed a decrease of 4.9% from the average production for 1921 and an increase of 37.2% over the average for the first ten months of this year.

Basic open hearth castings made during the month amounted to 974 tons, an increase of 137 tons or 15.2% over the preceding month, and most of the production was made for sale.

The output of bessemer castings declined slightly from 180 tons in September to 125 tons in October, a decrease of 30.6%. Electric castings also fell off 10.6%, the actual production being 831 tons in September and 743 tons in October.

The cumulative production of ingots and castings for the ten months of the current year amounted to 387,570 tons as compared with 549,792 for the same period of last year, a decrease of 29.5%.

Since these reports were compiled the second furnace has been blown in at Hamilton, while the Canadian Furnace Co. are getting ready for an early start while the other furnaces are getting shaped up for action with the coming of of spring. While everything looks encouraging, it is interesting to note what splendid customers we were for the producers of the United States even when times were at their best. In 1919 we imported from other countries $181,332,-310 worth of iron and steel, the great bulk of which came from the United States.

In 1918, $173,340,779 worth was imported. Here are some of the importations of 1919.

	Tons	Value
Pig iron and kentledge	35,800	$ 1,022,871
Ferro-alloys and chrome	16,423	943,584
Ingots, blooms, billets	12,135	494,101
Scrap iron and steel	39,790	482,963
Plates and sheets	183,061	12,820,340
Tin plate and sheets	43,407	6,436,047
Bars, rods, hoops, etc.	147,726	12,771,836
Structurals	184,813	11,142,997
Rails and connections	14,059	774,985
Pipes and fittings	1,277	90,879
Nails and spikes	2,359	228,580
Forgings, castings	19,935	3,325,859

The blast furnaces which were in existence in Canada at that time made a creditable showing as the following will prove:

Iron Blast Furnaces in Canada in 1919

Dominion Iron & Steel Co., Sydney, C. B.: Six completed furnaces; one of 350 tons capacity and five of 250 tons capacity each per day; No. 1, operated 309 days; No. 2, 214 days; No. 4, 237 days; No. 7, 126 days; two furnaces idle throughout the year.

Nova Scotia Steel & Coal Co., Ltd., New Glasgow, N. S.: Two stacks and one set of stoves at Sydney Mines, C. B., of 250 tons capacity; stack No. 1, operated 156 days.

Londonderry Iron & Mining Co., Ltd., Londonderry, N. S. (in liquidation): One furnace of 100 tons capacity idle throughout the year; not operated since 1908.

Midland Iron & Steel Co., Ltd., Midland, Ont.: Acquired in 1918 the Midland blast furnace plant of Canada Iron Foundries, Ltd., of Montreal, Que. One furnace of 130 tons capacity at Midland, Ont., operated 215 days.

Parry Sound Iron Co., Ltd., Midland, Ont.: Acquired in 1918 the blast furnace plant at Parry Sound, Ont., formerly operated by Standard Iron Co., Ltd. One furnace 90 tons capacity rebuilt and operated 240 days.

Standard Iron Co., Ltd., Deseronto, Ont.: One furnace at Deseronto with a daily capacity of 60 tons, operated 160 days.

The Steel Company of Canada, Ltd., Hamilton, Ont.: Two furnaces, one of 260 tons capacity, operated for 341½ days, a second furnace of 430 tons capacity operated 285 days.

Algoma Steel Corporation, Ltd., Sault Ste. Marie, Ont.: Four furnaces at Steelton, near Sault Ste. Marie, two of 300 tons capacity each; one of 500 tons, and one of 400 tons. No. 1, in blast 285 days; No. 2, 364 days; No. 3, 171 days, and No. 4, 141 days.

The Atikokan Iron Co., Ltd., Port Arthur, Ont.: One furnace of 175 tons capacity idle throughout the year, not operated since 1911.

The Canadian Furnace Co., Ltd., Port Colborne, Ont.: One furnace of 325 tons capacity operated 363 days in 1919.

Canadian steel Corporation, Ojibway, Ont.: Two stacks under construction, at the end of 1919 foundation had been completed for two blast furnaces of 550 tons each.

STUDENTS' COURSE ON BRASS FOUNDRY

(Continued from page 31)

practice. It is a metal which is not sufficiently well known to be popular and, consequently, not sufficiently used to be profitably refined and put on the market at a price which would make it popular, hence its limited use in the foundry so far. During the war, Canada was one of the greatest producers of this metal in the world, but since then it has not been much heard of, but it probably will be, when times get back to normal. Once it becomes sufficiently well known it will come into more general use, as there is abundance of it in all parts of the world. Next to silicon, aluminum, iron and calcium, magnesium is the most common of the metals. It is found in a great variety of forms and in many of the common minerals. Its production and cost, therefore, is dependent upon its use.

Prior to 1914, most of the magnesium used here was imported from Germany, and its production in this country was a direct result of the war. As a matter of fact, the electro-chemical method of reduction from the ore developed here results in a much purer metal than any of the imported product.

As a metal, magnesium is used to a considerable extent as a deoxidizing agent, particularly in brass-foundry work, and for this purpose it is very effective and comparatively cheap, but its use as a component in alloys may hardly be said to have been touched. One of its properties—that of increasing the fineness of grain of metals—suggests a wide field of application and very promising results from metallurgical investigations.

The physical characteristics of magnesium are such that it will undoubtedly find a wide field of usefulness. While it takes time to overcome inertia and conservatism, the future will find this metal playing an important part in industry. Some of the few things that we do know about it are: that it has, in its pure state, a tensile strength of 20,000 lbs. to the square inch, and specific gravity of only 1.74. Figuring these two we can easily prove that a straight bar five miles long, suspended from one end, would not have sufficient weight to break itself, whereas a bar of steel would only sustain itself to a length of about three miles before it would pull apart at the top end. Of course, there is no occasion to require a bar five miles in length, but I am using this to show what its adhesive qualities really are. With a tensile strength of 20,000 and a specific gravity of 1.74, a bar an inch square will hold in suspension a block of 184 cubic feet, which, if drawn out to one inch square, the same as is holding it up, it would be 26,500 feet long. Mixed with aluminum, magnesium acts the same as the metals already spoken of, which is to say, it increases the strength of the aluminum until the proper limit is reached, but if aluminum and magnesium are mixed half and half, the casting will be brittle, silvery-white and is used for mirrors. With aluminum having a specific gravity of 2.6, the addition of even a small amount of magnesium, while adding to its strength, reduces its weight, being an advantage where weight is objectionable.

In the next issue we will publish an interesting article on "Aluminum, Iron, and Electron," translated from the German by Wallace Dent Williams, showing some valuable metallurgical accomplishments brought out by the Germans when in a plight during the war. Later we will go more extensively into the subject of bronze, monel-metal, and the higher branches of non-ferrous metal work.

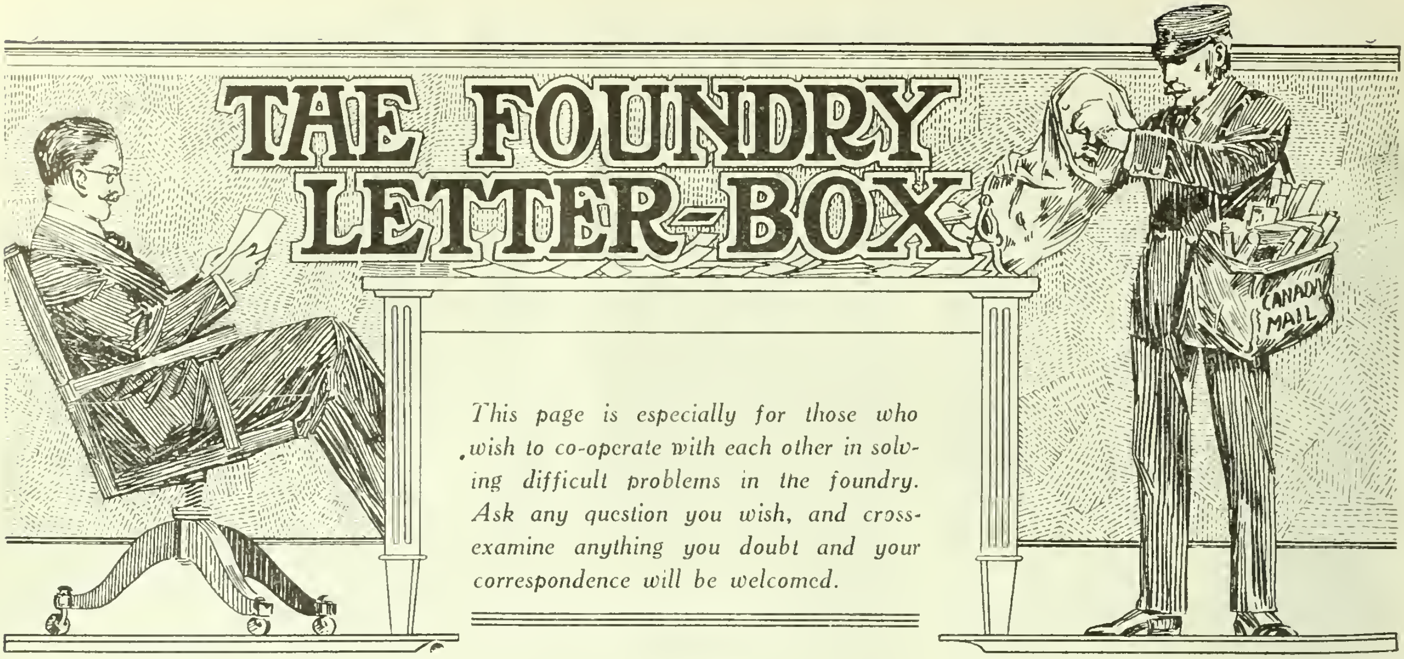
PLATING AND POLISHING

(Continued from page 30)

to 150 degrees Fahr. When the solution is ready for use, always use the solution at about this temperature for best results. In time the anode will discolor, if a thick, black scum forms on them add a little tin chloride, if anode takes on a yellow color add small quantity of caustic potash. If deposition appears slow and the bath sluggish when anodes are comparatively free from coatings add a little liquid ammonia. Use care in making additions in order not to get an overdose which may not actually cause trouble but renders the bath unbalanced and more or less freaky. A little experience will teach you.

DON'T WORRY

Worrying has the same effect upon your health and your mind that racing the engine while the automobile is standing still has upon a motor car. It uses up a lot of fuel and energy without getting you anywhere, and the more you do it the less fit you are to make any real progress. It never pays to worry. The only man who can benefit when you worry is your competitor. Don't worry.



CINDER MILL SHOT MAKES HARD CASTINGS

Editor Foundryman:—Being foreman in a foundry doing a high-grade line of casting such as engine cylinders, etc., I would like a little information. We recently installed a cinder mill, as we have had a large reserve of cinders which have been accumulating for years and which we know contain a large percentage of good iron. We are recovering from one to two tons per day. I melt the large pieces in with the scrap in the usual way, but the small stuff is accumulating faster than we can use it. I screen it all through a three-quarter mesh screen and use all that is coarser than this as ordinary scrap, but the balance is what I do not know what to do with. On one occasion I had five tons of it put into old tin cans and took off a running in the regular way. By slagging the cupola we melted it all successfully and poured it into unimportant work. The cans kept the metal from heat on a Saturday when we were not banking the blast and gave free space here and there for it to get through. We certainly got a lot of slag but we got about four tons of casting, and the balance we poured into pig beds, but the castings were very hard. We sent samples to the Kawin Company, Toronto, for analysis, which showed: silicon, 2.04; manganese, .27 to .29; phosphorus, 3.730; sulphur, .186 to .190.

You will see that it is low in manganese. I would like to bring the manganese up to .55 or .60 by adding ferro-manganese which will also neutralize the sulphur.

Which is the better way to do, put it in the cupola or in the ladles, and also how much should I use?

The silicon is also below our standard, as we like to run around 2.40, but 2.04 would not be bad for the castings we were making that day. Do you think ferro-manganese would soften the shot? We would like to run an entire heat of it once in a while on indifferent castings, but there is none of our work which can be classed as low grade. I tried putting some in on our regular work days, when we use six of pig and four of scrap, but it had a tendency to make the iron hard, so we can use very little of it in that way, maybe only about a half ton in a six-ton heat. Any help or information you can give me will be gratefully received.

Answer:—If you are getting 2.04 per cent. silicon in the castings made from all shot, you are doing exceptionally well, as this is about as high as you could get from any scrap. If you mix your iron, as you say, six of pig to four of scrap, and the pig is No. 1, carrying not less than 2.75 silicon and not more than .03 sulphur, you should be able to use one ton of the shot in each heat of six tons without making the castings hard. Putting the shot in cans is a good way of keeping it from smothering out the fire, but it must be remembered that tin is one of the worst hardeners, and if the cans were tin plated they should not be used. Even the sheet-iron cans would tend to harden the iron, while at the same time making a lot of slag.

Now, about the manganese.

Neutralize is hardly the word to use in connection with this material, as both sulphur and manganese are hardeners, unless you understand their chemical actions. Manganese, in proper proportion, will operate favorably on combined carbon, but its only usefulness in lessening the injurious effects of the sulphur is that sulphur and manganese have stronger chemical affinity for each other than they have for iron, and when mixed together they have a stronger affinity for slag than they have for the iron. If the furnace is working hot and is well fluxed and slagged, it will carry both the sulphur and the manganese out to some extent.

Adding the Manganese

There is only one way to add the manganese to the iron mixture, and that is by putting it in the cupola with the iron. Ferro-manganese is simply a mixture of iron and manganese, and whatever percentage of manganese it contains is all that has to be reckoned with. Now, if you want to raise the manganese content to the extent of, say, .25, this will mean a pound of manganese for each 400 pounds of shot, presuming that the rest of the iron is alright. If the ferro-manganese is 50 per cent. manganese, it will require two pounds of it to add one pound of manganese. If it is 10 per cent., it will require ten pounds to get one. That is all there is to mixing different brands of iron. The iron is always the same, and if it is the silicon or manganese content that is aimed at, use sufficient quantity of each brand to make up the right amount of the metalloid.

It must be remembered that if you have been years accumulating the cinders from which this shot is being recovered, it will take quite a while to get rid of it, but if you are careful about breaking the ferro-manganese into pieces of about the same size as the shot and mixing them well together before charging, you can use one ton of shot at each heat without using the cans. As I understand you are running half-ton charges, I would not put any shot on the first charge, but on each succeeding charge I would put on 800 pounds of your regular mixture and then throw two hundred pounds of shot on top of it before putting on the next charge of coke. You should have no trouble with it banking if thrown on in this manner, but if put on the coke, it does not do so well. You should also have a mixing ladle at the cupola spout to be sure that your castings do not have hard spots, and you will, of course, require to keep a good head of melted iron in the cupola in order to properly draw off the slag.

CONTEMPLATES INSTALLING SAND BLAST

Editor, Foundryman:—Is there anybody in Canada building sand blast equipment suitable for cleaning gray iron castings?

We manufacture steam retorts about 2½ feet square, ribbed on the outside for strength, and find considerable work in getting them clean.

Any information you can give us as to the efficiency of sand blast equipment for this work will be appreciated.

Answer:—To the best of my knowledge, there are no sand blast machines manufactured in Canada, but there are some first-class American concerns advertising these machines in Canadian Foundryman.

Regarding efficiency of this method of cleaning castings, I can certainly vouch for it. In the malleable iron foundries, where the unannealed castings are too brittle to put in a tumbling mill, the sand blast is used effectively. Also on gray iron castings which are too big or on trinkets which are too light and fragile to tumble, the sand blast is resorted to.

On castings such as you are making, with ribs on the face, the sand is probably burned into the corners. The force with which the abrasive is driven against the burned material will soon remove it. In this connection, I would say that there are other abrasives besides sand which are used in these machines. By perusing the advertising pages of Canadian Foundryman these artificial abrasives will be revealed. Sand is all right in its place, while the different metallic abrasives each have their field. It would not be policy for me to suggest any particular abrasive or make of machine, but I can assure you that none but reliable concerns are displaying their goods in the pages of Canadian Foundryman.

PRICES ON MUNICIPAL CASTINGS

Question:—We have a foundry and machine shop and would like to know what is considered a fair price for municipal castings under present conditions. There seems to be a great difference of opinion on this matter and keen competition is probably responsible for much work being done at starvation prices. Gate valves are also sold by the piece, 2-inch valves being quoted at $4.10 while the 6-inch are quoted at $16.50. These prices, which are a fair average of what were contracted for last spring, would yield a good profit under present conditions although none too high. It is a simple matter for a good foundryman to figure exactly what it costs to produce his castings, and then the speculation is what competitors will want in way of profit. Machining may be included in the price or may be considered as extras. As a rule very little is required.

Answer:—Municipal castings are being specialized on the same as everything else, and the foundryman who is equipped for producing them can make money at prices which would mean a loss to those who are not. Prices are, of course, cut closely and ordinary gray iron castings such as gully grates and sewer manhole castings range between $2.90 and $3.00. Water mains, which cannot be made in anything but pipe foundries, were quoted in the spring at $62 per ton, and contracts were taken for the year at this price, while the cast fittings brought 5 cents per pound. Extension boxes are sold by the piece, from $2 to $3, according to size.

PICKLE FOR CASTINGS

Editor, Canadian Foundryman:—We are manufacturing a line of machinery which requires clean, smooth castings. We do not operate a foundry, but buy our castings, and while they are good castings that we are receiving, they have sand burned onto them that we cannot scrape off. We would be pleased to have you advise us what pickling process would be best for removing this sand.

Answer:—One of the most common methods of removing sand from castings is to soak them over night in a solution of one part sulphuric acid (oil of vitriol) and 4 parts of water. This is to be kept in a wooden vat, painted on the inside with white lead. If a solution is kept boiling by having steam pipes running through it, several batches can be pickled during a day. This solution is only good where the scale is soft enough to be penetrated by the acid, which attacks the surface of the iron, leaving the scale loose so that it can be washed or brushed off.

If the sand is burned right into the metal there is only one acid which will remove it. Hydrofluoric acid will eat sand, and if kept in a glass retainer, will dissolve the glass, but it will not attack iron, neither will it affect wood, so a wooden vat constitutes the entire equipment. If the castings are immersed for two or three hours in one part of hydrofluoric acid and ten parts of water, the metal will be freed from sand as well as the hard magnetic oxide (scale). This solution is equally as effective on forgings, and is by all means the best method known.

USE RECORDS

Records that are never used are worse than useless. The time and the effort required to keep them has been wasted. Using records spells progress. Failing to use them means falling short of the greatest ultimate success. Records are guidebooks to future action. Their use makes it possible to escape pitfalls, to prevent waste, to avoid mistakes. The man who really wants to succeed will make the greatest possible use of records.

DAVID McLAIN RETURNS FROM LONG TRIP

David McLain of McLain's System, Inc., Milwaukee, Wis., who sailed for England early last summer to attend the Foundrymen's Convention at Birmingham, has just returned to his home in Milwaukee, after a five months' sojourn during which time he visited more than fifty iron and steel foundries in various parts of Great Britain.

David's visit to these foundries could not be considered exactly as pleasure trips, although any foundryman who has his heart in his work could not but take pleasure out of visiting as many foundries as possible. While he, no doubt, learned a lot about British ways during his stay amongst them, there is no possible doubt but what he left the British foundrymen much wiser for having seen him.

As soon as he gets his affairs in shape for another trip, he is going to pay Eastern Canada a visit, and has promised to tell us a lot of things about his trip to the Old Country. He has already told us about his last day over there, which will probably be included amongst his best ones.

Before sailing from Glasgow, the foundrymen of that city gave him a farewell banquet, or complimentary dinner in the "walnut room" of the Central Station Hotel. If the menu and toast list is a criterion of the esteem in which he was held in that great Scotch iron center, he must, certainly, have created a most favorable reputation. Following is the menu, which is interesting to read, if we cannot get any closer:—Crevettes Rose; Consomme a la Talma; Potage Polistro; Filet de Sole á la Minute; Filet Mignon Marie Louise; Grouse Roti á l'Ecossaise; Salade Marianne; Beignets d'Abricot; Glace; Viennoise; Mille Feuilles; Dessert; Café.

Toast List

The toast "The King" was proposed by Mr. John Cameron, after which a ten minutes interval with music, then "The Foundry Trades," by James K. Shanks; replied to by Bailie John King. Our Guest, "Three Gentlemen at once are you," by John Cameron; replied to by David McLain; "McLain Students," by W. Mayer, replied to by George Albert Ure.

After singing "Auld Lang Syne," the most enjoyable event was brought to a close, and Mr. McLain, after shaking hands all round, said, "Good-bye" and departed, preparatory to embarking for America.

As **indicating** the activity in woodworking machinery the Garlock Machinery Co., Toronto, report that sales during the past two months have exceeded those of the preceding months of the year. Metal working equipment, however, remains quiet, although enquiries give reason for optimism.

S. S. MOORE, Managing Editor
F. H. BELL, Editor

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Compliments of the Season

THE YEAR of Our Lord One Thousand Nine Hundred and Twenty-two, is fast drawing to a close, and ere we again have the opportunity of greeting our readers, another year will have been ushered in. The departing year, while not pregnant with notable events, has some things to its credit; it has been a record building year—every city, town and village seemed to have a building boom, so that we can safely say that our country is improving. Strikes in the coal mines and on the railroads have done a lot to upset business and retard progress. There has been an excessive number of automobile fatalities due to carelessness on the part of incompetent drivers, but unemployment has been much less in evidence than in the previous year and, on the whole, it has not been such a bad year in Canada, although none too good.

In Europe there has been a continuous turmoil, not to be compared with the great war, but just enough to keep the entire world in an unsettled state. Unemployment and want seem to be rampant in many parts of Europe, although our late adversary, Germany, is said to be the only country in the world which is really working on a normal basis, and where everybody is employed.

Great Britain still has a big unemployment proposition, but in the United States and Canada business is rapidly getting back into good shape. Unfortunately the metal working industries seem to have been the worst hit of any. Foundry business got quite brisk in May, and continued so throughout the summer but has fallen off to some extent during the last few months. This is attributed to stock-taking time being near at hand and prospective buyers being adverse to making any further expenditures until after the beginning of the new year, but every one who should be in a position to know seems to look favorably to the incoming year, and in this we trust that they are correct. Coming to our immediate dealings with our patrons, we have little to complain of. We lost business along with everyone else, but are glad to say that it is coming back, and like the rest of the optimists we are confident that the year which is before us will be a year of plenty. With these feelings we are in a proper frame of mind to wish our readers one and all a Merry Christmas and a Happy New Year, which we do with all our heart, and trust that the year 1923 will bring health and prosperity to all.

Value of the Technical Paper

THAT THE technical paper is gaining in popularity is evidenced by comparing the number of such publications issued to-day with the comparatively few at the beginning of the century. The enormous gain thus found, not only in the number of publications, but in their circulation, is not the result of the selling organizations of the various publishers, but is the direct result of the selling qualities of the papers themselves.

A paper which will not sell itself will soon go under. People who subscribe for papers will not renew their subscriptions if the contents of the papers are not to their liking. If a paper survives such times as we have been experiencing the last few years, it must meet with the approval of its readers, so we may conclude that all the papers which are being published at the present time are successfully performing the duties for which they were intended.

The technical and trade paper is particularly valuable because it only covers a certain field, and, unlike the daily newspaper which must consider rapid service as of prime importance regardless of accuracy, the technical and trade paper makes truthful representations as of first consideration.

The editorial section of the technical paper is the recognized authority on whatever line it represents, and not only this but the advertising section is the guide on which the manufacturer depends when about to make his purchases.

Since the technical paper is the recognized authority which would be hard to get along without, it is of first importance that it covers the entire field which it represents, and that it sticks close to the subject represented. This is the attitude that Canadian Foundryman has always taken. While it is read by practically every foundryman in Canada, it is also the only paper published in Canada or the United States which has a regular section devoted to pattern-making. This is done because pattern making and foundry work go hand in hand, and what interests one interests the other. While sticking close to the field represented is its aim, there are circumstances which are beyond its control, as it is on the table in the public libraries, hotels, boarding houses, etc., and can be read by any one who sees fit to read it. While the public library pays its subscription fee the same as any other subscriber, the results are probably more far-reaching than those of any other. Numerous instances have come to our attention, but we will cite but one.

An enthusiastic pattern maker wished us to publish an article on the "buzz-planer" showing the wonderful improvements which have been brought out on what he considered the most useful machine in the pattern shop. It was a well written article, and was considered worthy of publication, but it was not illustrated, so, in order to give it a presentable appearance we secured a couple of engravings from the Canada Machinery Corporation, of Galt, but, of course, their name did not appear anywhere in the article, excepting in a three-line paragraph at the end where we mentioned that we were indebted to the Canada Machinery Corporation for the use of the engravings. Had we thought that we were boosting anyone's business by so doing we might have abstained from even this courtesy, as it is strictly against our rules, the same as it is with any reputable publishing house, to give free puffs to any one in our editorial columns, but we could not help it—the pattern maker wanted his story published and we wanted our readers to have it, but the result was that in a few days the Canada Machinery Corporation received a communication from a saw mill man down in the Maritimes wanting one of those buzz-planers mentioned in Canadian Foundryman. This order was followed by one for a band saw and other machinery required to fit out a factory. This was unfair to other manufacturers of wood-working machinery but it was entirely unintentional on our part. Of course we now have a good "stand in" with the C. M. C. but for that matter we have the same stand in with everyone with whom we come in contact. There is magic in Canadian Foundryman. "Once read, always read."

Market Conditions and Tendencies

CONDITIONS in the foundry business are still unchanged to any extent, although those engaged in some lines continue to get increased orders, but in general those which were busy a month ago are still busy, while those which were slack are still slack. Building construction is still active with its constant demand on the foundries for such castings as are required, but the business which seems to flourish in spite of the mild winter is that of heating apparatus. Any foundry doing a business in stoves, heaters, hot air furnaces, hot water boilers, or radiators, can be depended on to be busy, but those in machinery are not any too rushed. The end of the year being close at hand probably has a lot to do with inactivity, but one great drawback has been the high price of pig iron, which everyone seems to consider due for a drop. This drop has been taking place from month to month until now first-grade iron is selling at $32.80, as compared with $33.80 in November. People will not buy in a declining market, but it is pretty generally conceded that prices will not decline much further. Whatever the price is in January, it will probably remain, and once the price becomes stabilized there will be active buying, as very few foundrymen have been buying other than in single carload lots, with the result that very little iron is on hand in any of the foundry yards. The prospects for 1923 are exceedingly bright, compared with what has been. In Montreal there is considerable optimism, due to the Board of Trade banquet tendered in honor of the new president of the Canadian National Railways, Sir Henry Thornton. It is expected that he will give an indication of his policy in regard to the co-ordination of the different groups of government-owned railways, and the business section is intensely interested in knowing if this is likely to shape out and also what plans may be devised for the enlargement of their equipment, both locomotives and freight cars. Nothing would be of greater interest to the Canadian manufacturer than to receive an indication that the near future is likely to see large orders for new equipment of this kind placed on the market. Very little has been doing in this line during the last two years, and the equipment is urgently needed and will, in all probability, be ordered. The shortage of coal, and the lessons learned thereby, have taught Canadians the value of their waterfalls, which can be utilized in generating electricity to take the place of coal. Several good contracts are about to be let for electrical equipment immediately after the New Year. If things materialize as those who ought to be reliable judges predict they will, the trade conditions during 1923, while not booming, should be good. With prices stabilized there is no doubt that this will be the case. Scrap dealers predict that there is no likelihood of any reductions in that time but that, on the contrary, the reverse will likely take place. While old copper is fairly plentiful, there is a decided shortage of the better class of scrap iron. Heavy melting steel is also scarce and dealers are building up their stocks in anticipation of good business soon. Coke prices, according to E. J. Corbett, Majestic Building, Detroit, are as follows:—Connellsville standard, low sulphur foundry coke $8.25 net ton, f.o.b. ovens; West Virginia coke with sulphur below 1% and ash 8%, $9.25 f.o.b. ovens. Prices of metal throughout Ontario and Quebec are ranging as follows:

No. 1 Canadian pig, Toronto	$32.80
Algoma No. 1, Montreal	35.15
Summerlee, Montreal	35.00
Gray Forge, Pittsburgh	28.77
Lake Superior Charcoal, Chicago	36.15
Standard Low Phos., Phila.	38.00
Bessemer, Pittsburgh	32.77
Basic, valley furnace	27.00

New Non-Ferrous Metals

Lake copper	$17.50
Electrolytic copper	17.25
Casting copper	17.00
Tin	42.00
Lead	7.50
Zinc	9.50
Antimony	8.50
Aluminum	22.00

Dealers' Buying Prices on Scrap Iron

No. 1 machinery scrap iron	$18.00
Stove plate	14.00
Malleable	10.00
Cast borings	6.00
Heavy melting steel	10.00

Non-Ferrous Scrap

Copper, light, per 100 lbs.	$ 9.00
Copper, crucible	11.50
Copper, heavy	11.25
No. 1 composition	9.00
New brass cuttings	7.00
Red brass turnings	7.00
Light brass	4.00
Medium brass	5.00
Scrap zinc	4.00
Heavy lead	4.50
Tea lead	3.00
Aluminum	11.00

Pig Iron.—The recent reduction in the price of Canadian iron has not stimulated fresh buying owing chiefly to the fact that foundries are presently well supplied and the market cannot consume new tonnage. The importation of Scotch and English brands has ceased with the close of sailings to the St. Lawrence, and on fresh demand developing later on Canadian pig will control the market.

Permits for new buildings to cost $662,000 were recently issued in Toronto. These include the new Jarvis collegiate to cost $500,000, and an addition to Malvern Ave. school to cost $25,000. The list include 39 dwellings, 34 garages, and 3 stores.

The **Dunlop Foundry Company**, operating an iron foundry in Woodstock, N. B., have been maintaining a busy plant all through the summer and fall and indications for further improvement are pronounced.

Senator Fred Thompson of Fredericton, N. B., who died recently, was for many years a partner in the old Fredericton Iron Foundry, known later as Thompson, McFarlane and Smith's Foundry and now known as Smith's Foundry.

Beldam Asbestos Co., formerly at 19 Jarvis St., have removed to larger quarters, 3 Mutual St., Toronto. Mr. Abraham, general sales manager for Canada, states that they have made selling arrangements with a chain of jobbers throughout the Dominion.

Shareholders of Dominion Iron and Steel Co. are asked to authorize an increase of the common stock of the company to $25,000,000. The company is now said to be operating on a profitable basis and furnishing practically full time employment to 23,000 men.

Weston, Ont., has annexed the **property** occupied by three industrial concerns—Moffats, Limited, Canada Cycle and Motor Co., and the Co-operative Wool Growers. A fixed assessment for 15 years was granted to Moffats, Limited.

James Fleming and Sons, Limited, St. John, N. B., one of the oldest iron foundry concerns in America, have been in existence for nearly one hundred years. The foundry has been operated on Pond Street in St. John, near the railroad station, for most of the period since the start.

The Gurney Foundry Co., have recently installed a pneumatic squeezer at their West Toronto foundry. The machine was supplied by the E. J. Woodison Co. of Toronto. It is the intention of the Gurney Foundry Co. to instal a large Jolt-Rollover machine in the immediate future.

The Record Foundry Company, Limited, manufacturers of Record ranges and heating stoves, have been busy at their Moncton plant, working steadily. This firm has been conducting an intensive advertising campaign in behalf of the Record ranges and stoves, in the newspapers and on the screen.

Massey-Harris plant, Brantford, reflects improved industrial conditions by the addition of from 250 to 300 men to the present staff of 500. The statement is made that this industry expects to have a busy winter. Other firms there report encouraging prospects.

It now rests with the Imperial and Federal governments whether guarantees are to be provided looking to the establishment of an iron and steel industry in British Columbia. An investigation of the ore resources of the province may be instituted.

The E. J. Woodison Co., have just supplied compressed air squeezing machines to the Standard Sanitary Co., Toronto, and the Brantford Brass Foundry, Limited. The plain squeezer, while limited in its capacity to light work, will do the work much more rapidly and satisfactorily than can be done by any other method.

The Courtney Iron Works is a new foundry just opened on Courtney Street, near Courtney Bay, St. John, N. B. This is not a very large establishment at the present time, but it is a real foundry and bids fair to expand. Harrigan and Howard, the owners and managers, are both formers employees of T. McAvity and Sons.

There are abundant ore deposits along the ranges of the north shore, extending from Les Embankment. The iron is impregnated with titanic acid, which has prevented development. This ore is now going to Niagara in large quantities, and with the electric process, the titanic acid can be extracted and used as a by-product.

The Standard Steel Co., which will operate here under the French name of Le Construction Cie., Limitee, expect to erect their plant next spring on a location two miles from the city but with good railway connections. They will employ forty to fifty men and will handle structural steel and ornamental iron castings.

Standard Steel Company, Welland, Ont., will establish a branch plant in Quebec City, and operate it under the French name, Le Construction Cie Limitee. They expect to erect their buildings in the spring on a site two miles from the city but with good railway connections. They will employ about fifty men and will handle structural steel and ornamental iron castings.

Steel mills and foundries, it was announced some weeks ago in these columns, had been asked to consider preliminary enquiries upon 3,500 box and refrigerating cars for the Canadian National. It is now reported that tenders have been sent out for between eight and fifteen million feet of lumber for car-building purposes.

The United States Smelting Co., Belleville, Ill., have recently installed two oil-burning furnaces in Canadian institutions. One, a furnace for melting non-ferrous metals in the foundry, was supplied to the Canadian Bronze Co., Montreal, while the other, an enamelling furnace, was supplied to the Sheet Metal Products Co., Toronto.

That Canada possessed great trade advantages in Colombia and Venezuela, as well as other Latin-American countries, is the opinion of Edward C. Austin, pioneer trade agent. These countries had shown strong development since the opening of the Panama canal. This market is closer to Toronto than is Calgary.

Dayton Steel Foundry Co., Dayton, Ohio, have just purchased a three-ton Moore Rapid 'Lectromelt furnace for their steel foundry. Their trade has enlarged to the extent that their old furnace equipment will not take care of it and the company is improving its equipment in view of its larger business. The 'Lectromelt furnace here replaces two furnaces of another make.

The Canadian General Electric Co. are so rushed with orders for transformers that they are running a night shift in that department. They are turning out some fairly large generators at the present time but are not so rushed in this line as they were a few months ago, although they have a number of splendid prospects in view, which they expect to proceed with immediately after the beginning of the new year.

The St. John Iron Works, one of the oldest iron foundries in the maritime provinces and which has been located at the foot of Charlotte Street, adjacent to the harbor, for more than thirty years, will receive a large share of business from the transatlantic steamers during the winter port season in St. John harbor. The St. John Iron Works is but a few yards from lower cove slip of the harbor, and many small vessels can reach the wharf facing the works.

An electric traveling crane of three tons capacity, has been installed at the east side foundry of the Canadian General Electric Co., Toronto, on purpose to handle the smaller sizes of transformer molds, which have, heretofore, been molded on the heavy work floors, thereby overtaxing the possibilities of the big cranes which were expected to serve all the molders at the same time.

Close students of the iron foundry trade in the maritime provinces report that 1922 has been much better than anticipated although, of course, conditions are not nearly as good as in the abnormal period during the war and during the reconstruction stage that followed the war. Indications are that the late winter, will see a further improvement in conditions.

The Union Iron Foundry, West St. John, N. B., which was partly destroyed by fire, has been repaired and an extension added to the foundry. This is one of the oldest iron foundries in Canada. George H. Waring, Sr., manager for many years, has been identified with the iron foundry business for more than fifty years. His son, George H. Waring, Jr., is superintendent of ferries of St. John.

That the McAvity family is well represented in the foundry business of St. John, N. B., is a well-established fact. The McLean-Holt Company, manufacturers of Glenwood ranges, with stove foundry on Albion Street in this city, have as their president, Mr. J. L. McAvity. This gentleman is not only a thorough foundryman but a noted soldier. During the recent threat of war with Turkey, he offered his services to the British and Canadian governments. During the Great War, Mr. McAvity was commander of the twenty-sixth regiment of the C. E. F.

Canadian Link Belt Co., Toronto, report that they are busier at the present time than at any time in their history. They have completed some very large installations during the year, and are at present installing a large unit in a coal mine in Nova Scotia, and another in an automobile plant at Chatham, Ont. They have several more installations in view, similar to the one being placed in Chatham, and have no thought of anything but a busy time during the winter and right through the coming year.

The Lewis Iron Foundry, on Britain Street in St. John, N. B., have been busy on fire escape orders. It is believed that this firm, which is another long-established concern, has manufactured more fire escapes than any other foundry firm in the maritime provinces. James Lewis, a former alderman, was the founder of the firm. Since his death the business has been directed by his sons, Frank and James. The latter was a candidate for the New Brunswick legislature in the last election. Frank Lewis is also interested in politics.

The Architectural Bronze and Iron Co., Toronto, have recently shipped to Stratford, two magnificent bronze statues, nine feet in height, which will stand on large stone base, designed to represent one of the hills, the taking of which fell partly to the lot of the Stratford contingent. This memorial is to perpetuate the memory of those from the Stratford district who fell in the Great War.

The Chemical Association, comprising manufacturers of equipment essential to manufacture in the score or more of chemically controlled industries of the continent, has established national executive offices at 1328 Broadway, New York City. It has begun active work through a national membership for the fostering of trade in chemical equipment, and for the improvement of practices in the production and distribution of such equipment, and in the performance of engineering services incidental thereto. e

The late R. B. Emerson, of Emerson and Fisher, wholesale and retail hardware merchants of St. John, was a member of the firm of the Enterprise Foundry Company, manufacturing Enterprise stoves at Sackville, N. B. Mr. Fisher is also a member of the firm. The late Mr. Emerson was chairman of the St. John Board of School Trustees for many years. He was a participant in many trade organizations and was president of the St. John Board of Trade for two years. Enterprise Foundry Company, Limited, have a western branch as well as the foundry in Sackville.

T. McAvity and Sons, St. John, N. B., Limited, have discontinued the Vulcan Iron Foundry, and have removed the equipment in that foundry to the Rothesay Avenue plant of the concern. The Rothesay Avenue plant was utilized during the war period as munitions works by the company on war orders. There are three buildings of steel, concrete and glass. The roofs are entirely of glass. Each of the buildings is in one story. It is the intention of the firm to transfer not only the iron foundry department of their business to the Rothesay Avenue plant but to, in the course of time, transfer the brass foundry department from the old Water Street building to Rothesay Avenue. T. McAvity and Sons, are one of the largest iron and brass foundry firms in eastern Canada, as well as one of the oldest.

The Milton Foundry, Machine and Tool Co., Milton, Ont., are building a large brick-dryer, for Streetsville branch of the Milton Presed Brick Co. All the brick yards in the famous Milton district are working night and day in order to cope with the demand for bricks. In fact, all the industries in and about Milton are busy. A new industry, to manufacture hosiery is being completed and will be turning out goods in January, while the P. L. Robertson Screw Co., and the Milton Worsted Yarn Spinning Co., are both adding large extensions to their buildings, and new equipment. Mr. D. Anderson, president of the Foundry, Machine and Tool Co., reports that his plant is running full time with a full complement of men.

Canada Electric Castings Co., Orillia, Ont., who purchased the plant of "Electric Foundries, Ltd.," but which was destroyed by fire in 1919, are again operating on a much larger scale than before. They were not, however, out of business during the intervening time since 1919, as they purchased a small brick foundry, in which they installed their equipment, and held their trade while they built a large modern foundry, around and over the one in which they were working, after which they removed the small one leaving the big one to handle the work. Their equipment consists of Electric furnaces, open-hearth, and oil-burning furnaces, in addition of cupola. Their production consists of gray-iron; carbon and alloy steels; carbon and chrome forgings; acid-resisting and bearing bronzes. In the bronze department they are producing manganese-bronze gearing by the centrifugal machine process, while in the iron and steel department they specialize in grinding-balls, linings, and crusher jaws for cement works and mining, as well as in high-grade electric melted gray-iron castings. They are employing 86 men at present and are optimistic regarding business, immediately after the new year. J. B. Tudhope is president of the company, while W. H. P Burrows is vice-president and general manager.

Sully Brass Foundry, Limited, who have for some years been carrying on a brass foundry business at the corner of Brock Avenue and Bloor St., Toronto, have secured the premises at 2388 Dundas St. West, formerly occupied by the Consolidated Steel Company, at the rear of the C. A. Ward fire proof building, and next door to the Grinnell Co foundry. This company, which does nothing but jobbing work, has not experienced any depression, but, although their Brock Street plant had seven pit furnaces, they had to run a night shift in order to fill their orders. In the new quarters they have already installed six pit furnaces and two large oil burning furnaces, and are still operating the Brock St. plant on aluminum castings, but will ultimately remove everything to the Dundas St. plant. Their equipment, while covering the brass foundry field is to be augmented by additional units. In the molding shop they have a hammer core machine, one Nichol molding machine and two Tabor machines. The rest of their work is done on snap benches and tubs, but these will be partially replaced by additional molding machines. Thirty men are employed, but this force will be increased when the new plant gets thoroughly settled.

Joseph Sully, Sr., is president of the company, while Joseph Sully, Jr., is vice-president and general manager.

BOOK REVIEW

American Malleable Cast Iron, by H. A. Schwartz; cloth, 416 pages, 6 x 9 inches, illustrated; published by the Penton Publishing Co., Cleveland, for $7 postpaid to addresses in North America and for 35s, post free abroad.

In 1826 in a small obscure foundry in Orange street, Newark, N. J., Seth Boyden made a discovery that formed the basis of the present "black heart" malleable industry. The process, which is quite different from that employed in Europe for making "white heart" iron, has been developed almost exclusively in the United States and Canada.

Because the product is so distinctly American in origin and growth, "American Malleable Cast Iron" is a logical and significant title for the new book written by H. A. Schwartz, which is just off the press. Containing 416 pages, 190 illustrations and 20 tables, and embracing chapters on history of the industry, methods of manufacture, principles of metallurgy, procedure for tests, and outline of properties, the text constitutes the most complete treatise on American malleable ever published. The work is made more comprehensive by a selected bibliography of nearly 200 references to chapters and articles in English, French, German, Russian and Japanese books and periodicals, and by a carefully prepared index in which liberal cross indexing is of valuable assistance to the reader searching for specific information.

In the eyes of practical men, the worth of a technical book often is measured by the experience and qualifications of the author. In this case, the text reflects the observations, study and research of a trained metallurgist whose life has been devoted to problems of the industry.

Any further comment on the book is unnecessary, as the book will tell its own story, and it should be in the library of every foundryman who is interested in malleable iron.

A comparison of British and American Foundry Practice is the title of a neat booklet published by Hodder & Stoughton, Warwick Square, E. C. 4, London, England, for the University Press of Liverpool. The book has 100 pages and is illustrated with numerous graphs, charts, etc. which are described in the subject matter of its pages. It was prepared by Professor P. G. H. Boswell, A. R. C. Sc., M. Inst., M. M., Geological Department of the University of Liverpool, and was inspired by the importance of the metal industries during the war and which has hitherto been under-estimated. Professor Boswell visited America and was cordially treated by the authorities at Washington as well as by presidents, vice-presidents and works-superintendents of different institutions visited. His visits included steel, iron and brass foundries, blast furnaces, rolling mills, forging shops, quarries, sand pits, etc., as well as universities and technical schools. He also had access to similar institutions in his own country and after studying the two, put the results of his investigations in book form. The book which was just off the press would have been published much sooner, but for the necessity of delay in order to complete the necessary laboratory work and analyses. The book is written in clear unbiased manner, showing the good and bad on both sides wherever they present themselves, but more often giving them just as they appear and leaving the reader to be his own judge. The price of the book is four shillings and sixpence net.

AMERICAN MALLEABLE CASTING ASSOCIATION WILL HOLD MEETING IN CLEVELAND DURING CONVENTION WEEK

Robert E. Belt, Secretary-Treasurer of the American Malleable Castings Association, advises that a joint meeting of the western and eastern sections of their association will be held in Cleveland concurrent with the Annual Convention of the American Foundrymen's Association.

The meeting probably will be held on Wednesday, May 2nd, and the technical program of the A. F. A. malleable session will be arranged so as to meet the convenience of the members of both associations. This means a big week for the men of the malleable casting industry of the country who are particularly interested in manufacturing processes and the technical side of this industry.

SLY BLAST, NOT SAND BLAST

The W. W. Sly Manufacturing Co., Cleveland, who have for years been manufacturing sand-blast machinery along with their other lines of foundry equipment, have come to the conclusion that "sand blast" is not a suitable title for a line of machinery which only uses sand in some of its operations, and have concluded that insofar as those made by their company are concerned they will adopt a more appropriate name and have, as a conseqence, made the following announcement:—

Undoubtedly you have noticed the tendency spreading throughout industrial circles to use abrasives other than sand with blast equipment. Chiefly, this is evidenced in the increased adoption of metal abrasives, shot, grit and iron crush, but for certain purposes, materials such as coke-breeze and pumice are equally well used, however, the industry at large has steadily clung to the expression "sandblast," when, as a matter of fact, sand is only one of many abrasives.

Properly designed, blast equipment will handle any abrasive the user decides is best adapted to give the finish or result required, after all, the important point when any equipment is selected is not—is it a shot blast or a sand blast—but whether the installation justified itself by its economy, its efficiency and its performance, as expressed in terms of production.

For some twenty years the W. W. Sly Manufacturing Company has specialized in blast equipment, considering this classification as of major importance in its line of cleaning room equipment. Slyblast equipment is universal in that any abrasive may be used, and the one which is recommended is selected because experience or test has proved it to be the best for obtaining the results desired. The Sly Company is not only selling a product, but a service—a service based on a conscientious effort to serve the customer's interest. As they do not sell abrasives, their recommendations regarding this matter are impartial.

It is with all these points in mind, as well as a desire to make their product and service distinctive, that the W. W. Sly Company announces that hereafter all blast equipment manufactured by them, instead of the title "sandblast," which is misleading, will bear the word "Slyblast" to set it apart in name, as it always has been in excellence of performance.

CATALOGUES

Canadian Ingersoll-Rand Company, Montreal, with factories at Sherbrooke, Que., have just published a new catalogue K-602-A, illustrating and describing "Circo" direct vertical lift air hoists, the development of which has been carried to such a point that they might be called reciprocating air hoists. They are now built in their entirety at the Sherbrooke works and stocked in all standard sizes. The catalogue shows the different usefulnesses to which the hoists can be put, not the least of which is the foundry, where some concerns supply each molder with one for lifting copes, drawing patterns, etc. One of their chief uses is in connection with the molding machine floor. Further description of the hoist is unnecessary, since it is fully described in the catalogue, which can be had for the asking.

SAFE FOUNDRY PRACTICE

(Continued from page 23)

"There are few machines in foundries in comparison with the number in industrial plants of many other kinds. The machines that are used, however, must be provided with guards at all points where accidents might occur, and the necessary special guards will be described in more or less detail in following articles. The construction and arrangement of the various forms of guards for belts and pulleys will not necessarily be fully explained, but it should be understood that these are to comply with the standards approved by the Industrial Compensation Rating Bureau.

"In the main the articles will deal with iron foundries; but we will also include certain special hazards that are encountered chiefly in foundries where other metals are cast."

Leading Editorial Articles During 1922

JANUARY

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FEBRUARY

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MARCH

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APRIL

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MAY

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JUNE

JULY

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AUGUST

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SEPTEMBER

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OCTOBER

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NOVEMBER

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DECEMBER

CLASSIFIED ADVERTISEMENTS

TWO CENTS A WORD, including the "Canadian Foundryman" box numbers; minimum charge is $1.00 per insertion, for 50 words or less, set in 6 point type. Each figure counts as a word. Display ads., or ads. set in border, are at card rates.

POSITION WANTED

BRASS FINISHER, GOOD ALL ROUND MAN, lathe and bench hand, plain pattern making, good knowledge of polishing and plating. At liberty July. Go anywhere. Box 704 Canadian Foundryman.

PRACTICAL FOUNDRYMAN, 25 YEARS ON light, medium, and heavy work, green and dry sand. Bench, floor and machine molding. Melt by analysis and thoroughly competent on Cupola practice. Good reference. Box 707, Canadian Foundryman. (C.3F.)

HELP WANTED

WANTED — McLAIN FOUNDRY FOREMAN, who has had experience in cast iron fittings, gate valves, and hydrants; for Canadian territory. Must be organizer, hustler and good on production. Traveling expense for interview will be allowed. State age, salary, and experience. Box 712, Canadian Foundryman.

POSITION WANTED BY FOUNDRY Foreman, 25 years practical experience on Stove, Furnace, Boiler Sections. Match Plates, and Moulding Machines. Capable of figuring costs. McLain graduate, presently employed but desires change. Address Box 706 Canadian Foundryman.

Bailey & Bell Fire Brick Co
Manufacturers and Importers of High Grade Fire Brick, Fire Clay and General Supplies. Special Shapes, Cupola Block, Stoker Brick, Boiler Tiles, Stove and Quebec Heater Linings.
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JAMIESON & FINLAY
Job Platers and Polishers
Nickel and Copper Plating and Galvanizing. Makers of Closet Seat Hinges.
68 Samuelson St. - Galt

PATENT NOTICE.

TO ALL WHOM IT MAY CONCERN:
Be it known that CHARLES PRACHE, of Paris, France, is willing to license any Canadian manufacturers under his Canadian Patent No. 203,025, for EVAPORATOR.
Further information may be had by applying direct to me, or to Messrs. Marion & Marion, 364, University Street, Montreal.

FOR SALE
FUEL OIL STORAGE TANK
10,000 Gals. Capacity

This is a new tank. We have not yet taken delivery of it, and offer it at a very attractive price. The tank will be sold within the coming week, so phone or wire if interested. Apply:
Mr. Vogan, The MacLean Publishing Co.
143 University Ave., Toronto Adelaide 5740

MODERN EQUIPPED FOUNDRY FOR RENT

A WELL-KNOWN MANUFACTURING plant will rent their UP-TO-DATE foundry to responsible party. They will also take large proportion of output.

Floor space of main foundry is 140 feet by 60 feet, and all modern equipment is included. Following are some of the UP-TO-DATE facilities:

LARGE CUPOLA, ELECTRIC OVERHEAD CRANE, CONTINUOUS ELEVATED TRACK, METAL POURING CRANE, SAND BLAST, TUMBLING BARRELS, PATTERN SHOP, COMPRESSED AIR LINES, CORE OVENS, RAILWAY SIDING.

This is the chance of a lifetime. None but responsible parties need apply. Rent reasonable and prospects particularly bright. For further particulars write, Box No. 709,
CANADIAN FOUNDRYMAN

FOR SALE

BARGAIN IN USED ELECTRIC FURNACE — A one-ton Volta Electric Furnace for melting steel, grey iron or Ferro alloy furnace, 220 volts, 25 cycle, 3 phase; complete equipment. For further particulars write Hiram Walker & Sons. Metal Products, Limited, Walkerville, Ont., P.O. Box 156. (c.t.f.f.)

FOR SALE—ONE SAND-MIXING MACHINE— Double-Cage type, ball bearings in oil bath throughout, gears of case-hardened steel. A bargain for someone. Box 710, Canadian Foundryman. (C.F.F.)

TAYLOR SAFES FOR SALE—RARE OPPORtunity to secure a safe at small cost. They are in splendid condition. Inside dimensions and prices are as follows: 15" deep, 2 ft. 6" wide, 3 ft. 11½" high, fitted with built-in compartment. Price $250.00. 18" deep, 2 ft. 8" wide, 4 ft. 5" high, fitted with steel compartment. Price $200.00. Apply Box No. 711. (CFF)

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Steel Ladles, Shanks, Flask Bands, Tote Boxes, Shop Barrels, Heavy Plate Tanks, Oily Waste Cans, Air Receivers, Smoke Stacks. Write For New Catalogue
THE STEEL TROUGH & MACHINE CO. LTD.
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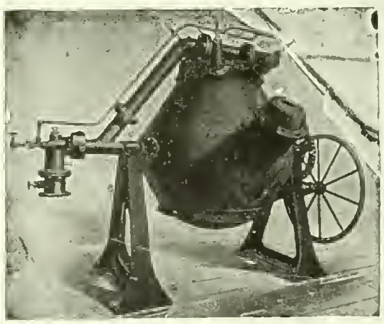
You've been going to send in that ad for weeks, so why not mail it now for next month's issue?
CANADIAN FOUNDRYMAN
143 University Ave. - TORONTO

Hawley-Schwartz

BETTER melts, in less time and at lower costs, are the results that go with Hawley - Schwartz Melting Furnaces. They are economy producers in every sense.



The Perfect Melter

THE Hawley - Schwartz heats uniformly and will handle all metal from 50 lbs. to 10,000 lbs.

Write for catalogue and complete information.

The Hawley Down Draft Furnace Co., Easton, Penn., U.S.A.

CANADIAN FOUNDRYMAN BUYERS' DIRECTORY

If what you want is not listed here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index facing the inside back cover, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Directory of Foundry Supply Houses

The Buyers' Directory of Canadian Foundryman was originally intended to contain information regarding lines in the production of which the advertisers actually specialized. We now carry the advertising of leading supply houses, some of whom represent scores of manufacturers, in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the supply houses so we recommend that for all general requirements our subscribers communicate with the supply houses listed below:

The Hamilton Facing Mill Co., Limited, Hamilton, Ont.

Frederic B. Stevens, Windsor, Ont.

The E. J. Woodison Company, Limited, Toronto, Ontario; Montreal, Que.

ANODES, BRASS, COPPER, NICKEL AND ZINC
W. W. Wells, Toronto, Ont.

ARGON
Dominion Oxygen Co., Toronto, Ont.

BRASS FURNACES
Hawley Down Shaft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.

CHEMISTS
Charles C. Kawin, Chicago, Ill.

CLAMPS, FLASK
Diamond Clamp & Flask Co., Richmond, Indiana

CORE MACHINES
American Foundry Equipment Co., New York City.

CORE OVENS
Monarch Engineering Mfg. Co., Baltimore, Md.
W. W. Sly Mfg. Co., Cleveland, Ohio.

CORE SAND
George F. Pettinos, Philadelphia, Pa

CRANES
Northern Crane Works, Ltd., Walkerville, Ont.

CRUCIBLES
Joseph Dixon Crucible Co., Jersey City, N. Y

CUPOLAS
Northern Crane Works, Ltd., Walkerville, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio.
Monarch Engineering & Mfg. Co., Baltimore, Md.

CUPOLA LININGS
Whitehead Bros., Buffalo N. Y.

DUST ARRESTERS
W. W. Sly Mfg. Co. Cleveland, Ohio.

EDUCATIONALISTS
McLain's System Inc., Milwaukee, Wis.

ELECTRIC RIDDLES
Great Western Mfg. Co., Leavenworth, Kansas.
Preston Woodworking Co., Preston, Ont.

FERRO-MANGANESE
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FERRO-SILICON
A. C. Leslie & Co., Ltd., Montreal, Quebec.

FIRE BRICK
Bailey & Bell Firebrick Co., Toronto, Ont.

FLASKS, SNAP
American Foundry Equipment Co., New York City.

FLASKS, STEEL
American Foundry Equipment Co., New York City.

FLUXES, IRON, BRASS, ALUMINUM, COPPER
Basic Mineral Co., Pittsburgh, Pa

GRIT AND SHOT, SAND-BLAST
Pangborn Corp. Hagerstown, Md.

MAGNETS
Dings Magnetic Separator Co., Milwaukee, Wis.

FLUOR SPAR
Basic Mineral Co., Pittsburgh, Pa.

FOUNDRY ENGINEERS
Charles C. Kawin, Chicago, Ill.
H. M. Lane Co., Detroit, Mich.
McLain's System Inc., Milwaukee, Wis.

FURNACES, OIL
Hawley Down Draft Furnace, Easton, Pa.
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES, GAS
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES COKE
Monarch Engineering Mfg. Co., Baltimore, Md.

FURNACES ELECTRIC
Pittsburgh Electric Furnace Corp., Pittsburgh, Pa.

GRINDERS, PORTABLE
Cleveland Pneumatic Tool Co., Toronto, Ont.

GRIT AND SHOT, SANDBLAST
Globe Iron Crush and Shot Co., Mansfield, Ohio.

HEATERS
E. J. Woodison & Co., Toronto.

HOSE COUPLINGS
Cleveland Pneumatic Tool Co., Toronto, Ont.

INDUSTRIAL ENGINEERS
H. M. Lane Co., Detroit, Mich.

IRON CEMENT
Smooth-On Mfg. Co., Jersey City, N.J.

IRON FOUNDRY CEMENTS
Smooth-On Manufacturing Co., Jersey City, N. J.

KAOLIN
Whitehead Bros., Buffalo N. Y.

MAGNETIC SEPARATORS
Dings Magnetic Separator Co., Milwaukee, Wis.

METALLURGISTS
McLain's System Inc., Milwaukee, Wis.
Charles C. Kawin, Chicago, Ill.

METALLIC GASKETS
Smooth-On Manufacturing Co., Jersey City, N. J.

METAL PATTERNS
Bryant Pattern Works, Windsor, Ont.
Hamilton Pattern Wks., Toronto, Ont.

MOLDING MACHINES
American Foundry Equipment Co., New York City.
Herman Pneumatic Tool Co., Pittsburgh, Pa.
Tabor Mfg. Co., Philadelphia, Pa.

MOLDING SANDS
Whitehead Bros., Buffalo N. Y.
Geo. F. Pettinos, Philadelphia, Pa.

OXYGEN
Dominion Oxygen Co., Toronto, Ont

PAINTS: CONCRETE
Smooth-On Manufacturing Co., Jersey City, N. J.

PATTERN MAKERS
Bryant Pattern Works, Windsor, Ont
Hamilton Pattern Wks, Toronto, Ont

PIG IRON
A. C. Leslie & Co., Ltd., Montreal.
Steel Co., of Canada, Hamilton, Ont.

PIPE JOINT COMPOUNDS
Smooth-On Manufacturing Co., Jersey City, N.J.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto, Ont.

PULLEYS
Dings Magnetic Separator Co., Milwaukee Wis.

RIDDLES
Great Western Mfg. Co., Leavenworth, Kansas.
The Preston Woodworking Machine Co., Preston, Ont.

SAND
George F. Pettinos, Philadelphia, Pa.
Whitehead Bros., Buffalo N. Y.

SAND CUTTING MACHINES
American Foundry Equipment Co., New York City.
H. L. Wadsworth, Cleveland, Ohio.

SAND MIXERS
Philips & McLaren Co., Pittsburgh, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
National Engineering Co., Chicago, Ill.

SAND SIFTERS
Great Western Mfg. Co., Leavenworth, Kansas.
Monarch Engineering & Mfg. Co., Baltimore, Md.
National Engineering Co., Chicago.
The Preston Woodworking Machine Co., Preston, Ont.

SAND BLAST HELMETS
Pulmosan Safety Equip. Co. Brooklyn,

SAND BLAST MACHINERY
American Foundry Equipment Co., New York City.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co. Cleveland, Ohio.

SAND MULLERS
National Engineering Co., Chicago, Ill.

SAND BLAST ABRASIVES
George F. Pettinos, Philadelphia, Pa.
Globe Iron-Crush & Shot Company, Mansfield, Ohio.
Pittsburgh Crushed Steel Co., Pittsburgh, Pa.

SAND RAMMERS
Cleveland Pneumatic Tool Co., Toronto, Ont.

SHOT AND GRIT, SAND-BLAST
Pangborn Corp. Hagerstown, Md.
Globe Iron Crush and Shot Co., Mansfield, Ohio.

SNAP FLASKS
American Foundry Equipment Co. New York City.
Diamond Clamp & Flask Co., Richmond, Indiana.

STEEL CEMENTS
Smooth-On Manufacturing Co., Jersey City, N. J.

TUMBLING BARRELS
R. MacDougall Co., Galt, Ont.
W. W. Sly Mfg. Co., Cleveland, Ohio

VALVES
Cleveland Pneumatic Tool Co., Toronto, Ont.

WELDING AND CUTTING SUPPLIES
Dominion Oxygen Co., Toronto, Ont.

INDEX TO ADVERTISERS

To keep an even balance with the particular, on the one hand and the peculiar, on the other, is something of an art; Stevens' Plumbago (direct from India) is doing just that.

It is suiting the most fastidious.

When you question that, in the least, send for a free working sample and prove my assertion. State the class of molds, whether for cylinders, for flat or raised and indented surfaces like ornamental Stove Plate and your prescription will be filled.

My warehouses are filled with good stocks of Foundry Equipment and Supplies; Electro-Plating Equipment and Supplies for I not only manufacture Foundry Facings, but, also Buffing Compositions and Brass Foundry Supplies.

Canadian shipments made from warehouse at Windsor, Ontario, thus avoiding all bother to the buyer from Custom House details.

STEVENS' STAMPED STEEL LADLES

All sizes in warehouse stock, from 60 lbs. to 250 lbs. capacity, each ladle is stamped from a single piece of steel.

FREDERIC B. STEVENS

Manufacturer of Foundry, Electro-Plating and Polishing Supplies and Equipment

Cupola Blocks, Fire Brick and Clay

Corner of Third and Larned Streets
DETROIT, MICH.

Or order from the nearest branch
CANADIAN BRANCH: Windsor, Ont.

INDIANA BRANCH:
Hoosier Supply Co.,
138 South Delaware Street
Indianapolis, Ind.

NEW ENGLAND BRANCH:
Frederic B. Stevens
51 Chestnut Street
New Haven, Conn.
Edward R. Sutton, Mgr.

PENNSYLVANIA BRANCH:
Frederic B. Stevens
250 West 12th Street, Erie, Pa.
Charles J. Menzemer, Mgr.

MILWAUKEE BRANCH:
Frederic B. Stevens
1350 National Avenue
Milwaukee, Wis.
A. M. Weis, Mgr.