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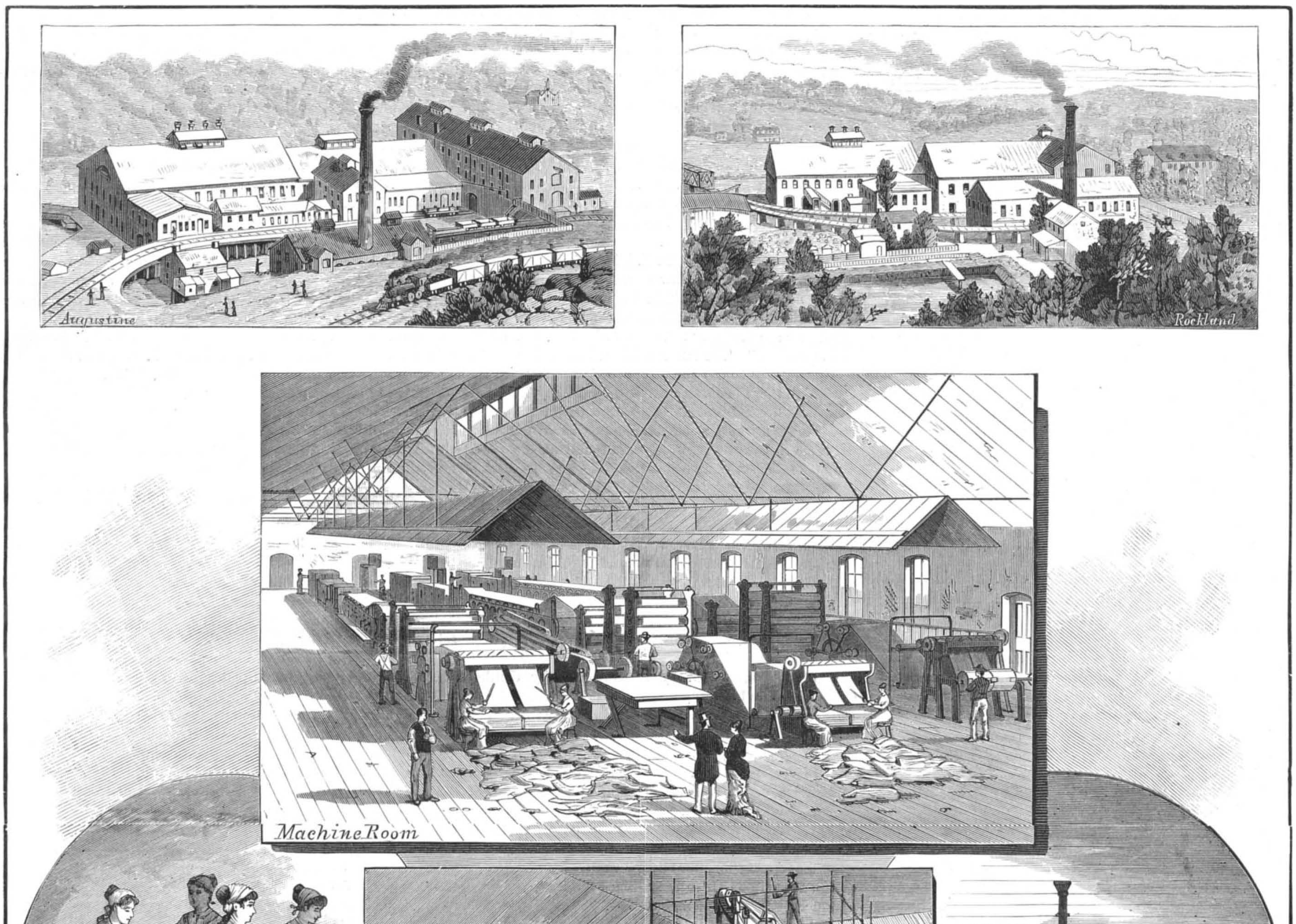

THE JESSUP & MOORE WORKS.—MANUFACTURE OF FINE PRINTING PAPERS FOR BOOKS, PERIODICALS, ETC.—[See page 372.]

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REMOVAL.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 441,

For the Week ending June 14, 1884.

Price 10 cents. For sale by all newsdealers

THE BROWN STONE QUARRIES OF CONNECTICUT.

Probably the most extensive quarries of red free stone or "brown stone" in the world are on the Connecticut River at Middletown and at Portland, on opposite sides of the river, fifteen miles below Hartford, the capital of the State. The Portland quarries on the east side of the river have been most extensively worked, and the place gives a local name to the stone as "Portland stone."

A recent article in the *Hartford Daily Times* gives an array of facts concerning these celebrated quarries, some of which are quoted in this article. It appears from undoubted historical evidence that these quarries were worked in 1645, 239 years ago, as there is an ordinance alluding to them at that time. The deposit of brown sandstone at Portland covers an area of 200 acres, and is practically inexhaustible. It lies in horizontal strata, usually with each stratum in the upper levels varying a trifle from the other in fineness of the sand. Occasionally there is found an intermixture of fine pebbles. Generally speaking, the deposit is not unlike that of silt upon a beach. In one of the three quarries now worked, several acres have been quarried to a depth of 200 feet below the surface. As an experiment, some years ago, to decide for business reasons the probable depth of the sandstone, a diamond drill was started downward from the 200 foot level. It was driven 312 feet, making 512 feet in all, and without reaching the bottom of the deposit! A core that was taken out showed no material change in the character or quality of the rock.

"The sandstone" says Prof. Rice, of Middletown, "was deposited in a long, narrow estuary, extending from New Haven nearly to the northern boundary of Massachusetts. No fossils have been found except trunks of trees and tracks. The latter are probably not tracks of birds, but of reptiles and amphibia." The latter opinion, it will be noted, is directly contrary to the popular belief in the "bird tracks," for which the Portland quarries are widely known. The sandstone lies in horizontal strata, usually, and every few feet there is a well defined horizontal crack. On lifting a flat section of stone, the tracks are found on the surface of the stone beneath, with corresponding projections of the upper stone fitting into them. Professor Dana, in that model text book, "The Geological Story briefly Told," coincides with Professor Rice that the tracks are those of reptiles and amphibia. The late Edward Hitchcock, father of the present State Geologist of New Hampshire, and a famous writer on geological topics, was the first to assign to these fossil tracks in the Connecticut Valley sandstones their true significance in geology. His views were received with incredulity at first, but have since been adopted by the scientific world.

The stone is removed by blasting and by drilling and splitting. The blast is generally of powder in a single hole—from 25 to 60 pounds of powder in a nine inch hole 15 or 20 feet deep. The object of this is to shatter the rock, so that it may be easily broken into rubble for foundations. When large and regular blocks are required, a chiseled cut is made one or two inches wide and of varying depth, into which wedges are driven with sledges, and the block slides off at the interception of a horizontal seam. Flood, the California millionaire, has given the Middlesex Quarry Company an order for the stone for the grand mansion he is to erect in San Francisco. It calls for 40,000 cubic feet of best quality, such as is used for monuments. This will make twenty-five schooner loads. It is shipped to Newark, N. J., there dressed, boxed, and sent to New York, to be shipped for a four months' voyage around Cape Horn. The freight is $7 per ton, and Flood pays, therefore, $28,000 extra over the cost of putting up a similar building in New York. It is estimated that the bill for stone, when set in the walls of his residence, will amount to $200,000, but this is a small amount for the mere shell of the house, whose total cost will be nearly $2,000,000.

GAUGES FOR MECHANICAL WORK.

In a lecture delivered before the Franklin Institute a short time ago and recently published, Mr. George M. Bond spoke of the modern accuracy in the work of the machinist as compared with former crudity. James Watt, in a letter to a friend, claimed that he had attained remarkable accuracy in boring a cylinder of a steam engine and fitting its piston so closely that "the thickness of a half crown could not be introduced between them." Standard gauges are now made that show errors of one one-hundred-thousandth of an inch, and work is exacted to one fifty-thousandth of an inch. Such accurate work is not, however, generally necessary, except in the construction of gauges; but these standard gauges are the means provided for keeping within proper, useful, and practicable bounds in the production of thousands of pieces of the same size and shape in which oftentimes a certain amount of variation is allowed both *plus* and *minus*. A certain amount of looseness must be allowed, for instance, in the fit of journals and bearings, the amount to be determined according to the length and size of the journal; but this variation should be referred to some particular gauge as a standard.

This allowance of difference is necessary in the fittings of bearings and journals, as, if made with the extreme accuracy of gauge work, the surfaces would cohere and speedily destroy each other. This is seen in the construction of end measure pieces as gauges; where two are pressed together by their ends they will cohere even in a vacuum. In the perfect fit of plug and ring gauges where the plug is inserted in the ring, both being of hardened steel and both at the same temperature, it is necessary to keep the plug moving, or the easy sliding fit will change to a driving fit. In fact, there is no room for one to expand and not the other. A plug gauge of three-quarters of an inch diameter, but which is three-ten-thousandths of an inch smaller than the ring, is a loose fit which can be tested by feeling; and if the plug and ring are clean and of the same temperature, the plug will drop through the ring.

In order to make standard gauges within the limit of accuracy necessary for interchangeability, to fulfill the requirements of modern shop practice, line measure is the best standard for practical reference. This measurement is by means of engraved lines on a ruled steel bar, the tests being made by the microscope. For this purpose a hardened steel bar is used, the subdivisions being ruled or engraved by a diamond.

OUR NEW SUPPLEMENT CATALOGUE.

A new catalogue of valuable papers contained in the SCIENTIFIC AMERICAN SUPPLEMENT is now ready, and will be supplied gratis to all readers who choose to send us their names.

This catalogue exemplifies the astonishing progress that is now being made in the various branches of science and the arts. Not quite ten years have elapsed since the publication of the SUPPLEMENT was begun; yet within this brief period many important discoveries have appeared and many great works have been undertaken or completed. Among them the Telephone, the Electric Light, the Panama Canal, the Brooklyn Bridge, the St. Gothard Tunnel, are conspicuous. The SUPPLEMENT records the complete history of these and many other useful achievements; it presents in compact form the most recent papers by eminent writers in all the principal departments of general, technical, and theoretical science, embracing Biology, Geology, Mineralogy, Natural History, Geography, Astronomy, Archæology, Chemistry, Electricity, Mining, Mechanical Engineering, Technology, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. The array of authors is great; it includes almost every prominent name connected with science, such as Huxley, Tyndall, Crookes, Maxwell, Siemens, Reynolds, A. M. Mayer, Bessemer, Tissandier, Dumas, Gladstone, Newberry, Remsen, Leeds, Mallet, Thompson, Hughes, Hopkins, Trowbridge, Ericsson, Copeland, Sellers, Eads, MacCord, Hammond, Loomis, and hundreds of others. Most of the papers contained in the SUPPLEMENT are illustrated, many of the drawings being to scale.

The new catalogue occupies 24 large quarto pages, same size as SCIENTIFIC AMERICAN. The extensive range of its subjects will be understood when we state that it includes over 5,000 titles. Stereotype plates of all the issues of the SUPPLEMENT have been preserved, thus enabling us to supply, on call, any particular number that may be desired, at 10 cents per copy. No periodical in the world offers so large and varied a collection of scientific, technical, and useful papers, all of them readily available to the public at a low price, as the SCIENTIFIC AMERICAN SUPPLEMENT. As before stated, the new catalogue will be sent, free of charge, to any desired address. Send for it to Munn & Co., 361 Broadway, New York, office of the SCIENTIFIC AMERICAN.

A SUGGESTED LATHE IMPROVEMENT.

The ordinary back-geared engine lathe of the machine shop is not a special tool, it being used generally for turning, boring, and screw cutting, and frequently for drilling and chucking. There are, however, special lathes, as boring lathes, pulley lathes, and others. It is proposed to add to the list of special tools for the machine shop a screw cutting lathe of a pattern somewhat different from the ordinary back-geared lathe. In constructing a special machine recently, on which the principal rotating spindle had to be reversed in motion instantly and frequently, the superintendent introduced a supplemental spindle carrying two step cones with their small ends contiguous. These turned freely on the spindle, and were belted to run in opposite directions. Between them was a sliding friction clutch that by a very slight movement of a lever could be made to engage with either cone, as desired. The arrangement suggested the possibility of an improvement in screw cutting lathes by constructing the lathe head in a similar manner, and dispensing with the overhead clutch, which requires so long a lever that the time used up in shipping interferes with accuracy of work.

The details are not completed as yet, but the superintendent, who is a skillful mechanic, is confident that much is to be gained in the way of positive and instantaneous reversing by having the clutch directly under the operator's hand.

A REMARKABLE STRAIGHT EDGE.

Some notice was made in the SCIENTIFIC AMERICAN of March 29, 1884, of a trio of remarkable straight edges made by the Pratt & Whitney Company, Hartford, Conn., which are each 12 feet long and wonderfully exact. These straight edges are castings of iron, forming a chord and a segment of a circle, the extreme radius in the center, from the chord or straight line to the highest point of the curve, being 20 inches, the depth gradually tapering on a curve. The width on the face is about 2½ inches, making a face 2½ inches by 12 feet. Between the chord and the curve the casting is a honeycomb of diagonal braces. Recently some remarkable tests have been made with these straight edges, one of them being a test of flexure. The straight edge was placed on a true and perfectly clean planer bed, with a slip of tissue paper under each end. These slips raised the entire straight edge, so that another slip of tissue paper could be moved under its face from end to end. Then a man weighing 220 pounds sat on the center without deflecting the straight edge a particle. But in order to avoid all opportunity for error on account of the possible inequality of the planer platen, two of the straight edges were placed face to face, one on the other with the shims of tissue paper between, and the superimposed weight of a heavy man, with the same result; the middle slip of tissue paper could be slid between the two faces at any point between the end shims. It is doubtful if better accuracy has ever been secured.

Milk Testers.

The instruments used for testing milk are the thermometer, the cream gauge, the lactometer, the lactoscope, the pioscope, and the lacto-butrometer. The value of milk testers has, however, according to the *Farmers' Gazette* (Dublin), been but little appreciated by British dairy farmers in the past.

"In all those countries with which British dairy farmers have to compete the farmer would be laughed at," adds the *Gazette*, "who would attempt the making of either cheese or butter without testing apparatus. A dairymaid would be surprised if you proposed to make butter or cheese without a thermometer, and even a complete set of testing apparatus, to enable her to go to work scientifically and successfully." It is therefore satisfactory to note "that dairy farmers and town dairymen in England are becoming alive to their position in competition with the continent of Europe, the United States of America, and our colonies."

The proportion of cream in any sample of milk can be determined by the cream gauge, which is simply a glass tube, about five inches long, graduated from zero downward. The milk to be examined is poured into this tube up to zero, and allowed to stand about twelve hours, at the end of which time the cream will have raised to the top, and its percentage may be read off. This instrument, although very useful to those who sell cream, is not reliable in detecting the adulteration of milk.

The lactometer, or hydrometer for milk, indicates the specific gravity of milk; that is, the relative difference in weight between milk and water. The specific gravity of water is 1,000, and that of milk may be taken to average about 1,030.

The specific gravity of milk varies, however, not merely with the amount of water it contains, but with the amount of butter fat in its composition, and for this reason the lactometer used alone is of little or no practical value. As cream is lighter than milk, and of nearly the same specific gravity as water, it follows that when milk is very rich, or contains a large proportion of butter fat, its specific gravity is less than the ordinary standard, and if tested by the lactometer alone might give the idea that it had been watered. A cream gauge should therefore always be used in connection with the lactometer, in order to test the amount of cream or butter fat in milk.

The best instrument for testing the value of milk hitherto invented is the so-called lactoscope. This shows, with considerable accuracy, the percentage of fat; and fat, being the most valuable constituent of milk, forms a safe gauge as to the purity and value of the milk.

The action of this instrument depends upon the fact that the opacity of milk is chiefly caused by the globules of cream So that when water is added to milk until we can see through a certain proportion of it, we are able to do so because we separate the cream globules to that extent that light can pass through between them with a certain degree of clearness. Then, if we measure the amount of water added, we have quite an accurate gauge for comparing different samples of milk.

Overcrowding the Principal Cause of Diphtheria.

Dr. T. J. Hutton has, within the past three years, treated sixty-four cases of diphtheria, occurring in Minnesota, and says in the *Medical Record*: These cases were all in comparatively new houses, in a belt of country where white men never lived before, so that the soil contained no sewage and had no accumulation of surface filth. Diphtheria had never before been there, and could not have been brought by visitors; it was of a malignant type, and some families lost five and six members each. All of the cases were included in seventeen rural outbreaks, three of which were in summer and fourteen in winter, and every house attacked was small and greatly crowded. Many of the winter outbreaks happened when the temperature was 30° to 40° F. below zero, which would have been death to all ordinary surface germs, and in one instance the thermometer registered 60° below, when the surface of the earth and all bodies of water were frozen solid. From the experience thus derived, of all the details of which a careful record was kept, Dr Hutton adopted a plan of treatment, which he summarizes as follows:

1. Diphtheria is caused by ochlesis, or crowd poison. 2. It is an emergency—"an event or combination of circumstances which calls for immediate action or remedy." 3. It is at first a local disease, resembling the animal poisons —snake bite, mad dog bite. Properly treated in this stage, it is one of the most curable of diseases. 4. It is contagious and infectious, and the poison may retain its vitality from three months to two years. 5. This poison is not identical with that of measles, croup, or scarlet fever, nor is it intimately related to them. 6. Diphtheria may occur sporadically; any small overcrowded, ill-ventilated house may prove a diphtheria factory. 7. Its period of incubation is from twelve hours to several days. 8. Directly, temperature none; indirectly, much. Crowding can occur in any temperature; practically it occurs most in cold weather. 9. In the local stage there is but one indication—to destroy the false membrane already formed; prevent further formation and spread. For this only two remedies are required as a rule. 10. In the stage of systemic infection there are two indications—the foregoing, and to support the system. A remedy or combination, internally, with food and stimulants meets this indication. 11. An abundance of pure air is the first requisite in treatment. 12. Being an asthenic disorder, and prone to heart failure, rest in the recumbent position and warmth to the extremities assist in the cure. 13. The physician must not only prescribe, he must administer the local treatment, when present, and see to it that food and medicine are administered punctually in his absence. 14. The physician should visit severe cases three times a day; all cases at least once a day for the first nine days. 15. The physician should not despair, though called late. I have seen patients, apparently moribund, restored by fresh air and food alone. So have other observers.

The two remedies used in the local stage are lunar caustic and chlorate of potassa. Twenty grains of the former in one drachm of water is applied thoroughly every hour or two to the affected parts, and continued so long as there is formation of membrane, whether two days or seven. A saturated solution of the chlorate is used as a gargle every fifteen minutes. One ounce and a half of potassa is ordered to eight ounces of water. The latter administered internally, if the patient be too young to gargle. I use none but Squibb's. Common liquid food. This has been the sole treatment when called early.

With the second stage, or to forestall it, comes the second indication, to support the system, "the disease being perhaps of more lowering character than any other with which we are acquainted." As a rule, three remedies meet this indication: Chlorate of potash, tincture of iron, and quinine. For adults these formulæ are used:

Tincture ferri chloride, ʒ v. Quin. sulph., gr. xvj. Sirup cort aur., Aq. M. P., āā q. s. ad ℥ iv. A teaspoonful every two hours.

Potass. chloral, ʒ iv. Aq. dest., ℥ iv. A teaspoonful every two hours.

These are administered alternate hours, night and day, if patient be awake.

Five remedies—lunar caustic, chlorate of potassa, tincture of iron, quinine, and carbolic acid—meet both indications fully as a rule. In all cases carbolic acid is used as a disinfectant, and in nasal cases it is used in the form of a vapor, or in glycerine, or in a one per cent aqueous solution.

In the septic stage the diphtheria patient can hardly be overfed or over-stimulated. Many die for want of food and stimulants to tide them over, the popular notion being that sick people do not require food, especially those who manifest febrile action. Two quarts of milk, each pint holding a fresh egg in solution, one cupful of homemade beef essence, properly seasoned, a pint of pure port wine, or half that quantity of pure brandy, form a fair skeleton of one day's rations for an adult. Food and stimulants are administered every hour.

How Paper Pails are Made.

At a paperware factory in Syracuse, N. Y., intended to turn out 500 paper pails a day, the process of making is thus described in a local paper:

Rags and paper waste are steamed in vats for a few hours, and then thrown into beating troughs partly filled with water. The "beating" is done by a revolving cylinder with fifty knives set at different angles. The knives reduce the rags to a dirty purple pulp, and change the newspaper wrappers to a soft mass. About 400 pounds of material are put under each beater. When paper and rags are each reduced to pulp, the opening of a trap lets it run into the stuff chest in the cellar. One part of rag pulp to three of paper is run into the chest. When pumped from the stuff chest into the trough of the winding machine, the future pail looks like thin water gruel. A hollow cylinder covered with brass wire splashes around in the trough, and the pulp clings fast to the wire. After the cylinder has performed a half revolution it comes in contact with another cylinder, covered with felt, that takes off the pulp. As the large cylinder goes down on the return trip, and just before dipping into the trough again, all little particles of pulp sticking to the wire are washed off by streams of water from a sieve. On the inside of the cylinder is a fan pump that discharges the waste liquid.

From the felt covered cylinder the pulp is paid on to the forming cylinder, so called. It is about the shape of the paper cone caps worn by bakers and cooks, but made of solid wood and covered with zinc, with the small end or bottom part of the pail toward the workman. The forming roll drops automatically when pulp of the required thickness is wound around it. From here the now promising pail is put in the pressing machine, which looks something like a silk hat block, in six sections, with perforated brass wire upper faces. The sections move from and to a common center, and the frame is the exact size of the pail wanted. The workman drops his damp skeleton of a pail into the frame, touches a lever, and the sections move to their center and squeeze the moisture out of the pail. The pail is still a little damp, and spends a few hours in the drying room at a temperature of about 150. The sections of the pressing machine mark the bands which are seen on the finished pail. After it is dry the pail is ironed, or calendered, as it is called. The pail is drawn, like a glove, over a steel forming roll, which is heated, and is ironed by another revolving calender, with steam thrown on the pail to keep it moist as if it were a shirt bosom. The pail, or rather its frame, is pared at each end, punched with four holes to fasten on the handle, and corrugated, or channeled, for the putting on of the iron hoops. A wooden plate large enough to spring the pail so that the bottom can be put in, is inserted and the paper bottom held under a weight which drops and knocks the bottom where it belongs. The factory has a machine of its own invention for the bending of the hoop into shape.

After it has been cut to the proper length and width, the straight strip of iron is run over a semicircular edge of steel, on which it is held, and drops on the floor a round hoop with a fold in the middle to catch the top and bottom edges of the pail. After a waterproof composition is put on, the pail is baked in a kiln for about forty-eight hours at a temperature between 200 and 300 degrees. It is dried after its first coat of paint and sandpapered, and then takes two more coats of paint, with a drying between, and a coat of varnish which is baked on, before—with its wooden handle and brass clamps—the pail is ready for the hand of the dairymaid, hostler, or cook.

Insect Pests.

A subscriber to the *American Cultivator* relates how it sometimes happens that the destructive pest known as the canker worm makes its appearance on the apple tree all of a sudden, even where it has not been in the habit of visiting. Then, of course, it is too late to use any preventive, therefore a cure must be sought. I have found, says the writer, under certain conditions that this worm can be destroyed by the use of Paris green. Put a heaping teaspoonful of Paris green into a pailful of water, apply the mixture with a force pump, throwing the water through the tree thoroughly. This should be done as soon as possible after the presence of the worm is ascertained. I found one application to be sufficient. Soon after the application of the liquid, the worms can be seen to let go and string down from the tree.

The present is the time for looking after the currant bushes, and if the currant worm makes its appearance, apply powdered hellebore. Place the powder in a common dredging box, and sprinkle the bushes when the dew is on. I have usually found it necessary to go over them when in blossom, then again after the fruit is set and of considerable size. This remedy has never failed with me, and does not injure the fruit.

The Corrosive Action of Cements upon Metals.

The late Mr. J. C. Trautwine, civil engineer, published a brief memorandum, giving the result of some experiments which he had made to determine the corrosive action of hydraulic cements upon metal embedded in them. The cements used were English, Portland, and Louisville; in addition to which he tried plaster of Paris pure, and also mixed with equal measures of the cements. All were of the consistency of common mortar; and all were kept in an upper room during ten years, unexposed to moisture other than that of the indoor atmosphere. The metals were partly embedded in the pastes, and partly projected from them. They consisted of cut iron nails, some of which were galvanized; smooth iron wire nails; brass in both sheet and wire; zinc in sheet; copper wire; and solid cylinders of lead ⅜ inch diameter. The result at the end of the ten years was that all the metals in both the pure cements were absolutely unchanged; and this was also the case with the plaster of Paris, with the exception of the ungalvanized nails, which had become covered with a thin coating of rust, as were also those in the mixtures of plaster and cement, but to a less degree. Mr. Trautwine concludes from his experiments that if dampness be excluded, both cement and lime mortar will protect from injury all the metals employed in ordinary constructions for an indefinite time.

Forbidden Coloring Materials in France.

Serious accidents have frequently resulted from the employment of wrapping paper colored with poisonous materials for packing alimentary substances.. The "Prefecture de Police," Paris, have therefore issued the following regulations:

Manufacturers and dealers in all kinds of food are forbidden to use the undermentioned colors, and will be held personally responsible for any accident which may occur from such use of them.

MINERAL COLORS.

Containing copper—"Cendres bleues," mountain blue. Containing lead—Massicot, minium, pale orange, oxychloride of lead, Cassel yellow, Turner's yellow, Paris yellow, white lead, ceruse, silver white, Naples yellow, sulphate of lead, chrome yellow, Cologne yellow, chromate of barium. Containing arsenic—Arsenite of copper, Scheele's green, Schweinfurt green, vermilion.

ORGANIC COLORS.

"Aconit Naples;" fuchsine and its immediate derivative, such as Lyons blue, eosine; coloring materials containing nitrous compounds; such as naphthol yellow, Victoria yellow; tropeolines, xylidine red, etc.

Children's toys must not be colored with poisonous pigments.

The Cod Liver Oil City—Hammerfest.

If we pass the wonderful Lofoden Islands, and continue the route toward the north, we arrive at Hammerfest, where we quit the birds for the fishes. As for the city itself, imagine a town watered by cod liver oil, and you will have some notion of the odor. The captain had warned the party beforehand, but their handkerchiefs steeped in eau de Cologne were but a slight defense. This horrible smell is due both to the important manufacture of the oil and to the thousands of fish on hurdles drying in the sun.

The two to three thousand inhabitants of Hammerfest, the most northern town in the world (71° N.), are all occupied in this trade. Suffice it to say that a single boat well equipped, well stocked with bait, and in a good place can take from 500 to 600 cod a day. The scientific estimate that the ovary of a female of ordinary size contains nine million eggs. This is the mode of preparation:

First they remove the head and abdominal viscera; the ovary serves for bait; the liver yields the oil. Not long ago the heads were wasted; now they are dried and powdered and used as manure for poor land.

The body, dried hard and rolled in sticks, is called stockfish, which is imported chiefly into Greece, Italy, France, and Spain.

The fresh livers are piled in barrels, slightly pressed, and the virgin oil runs out, unfortunately a kind rare in pharmacy, though its quality is beyond doubt superior. Then the livers are treated by a press similar to those used in Normandy for cider.

This is oil, second quality; color, reddish brown.

The waste livers are subjected to strong heat, and an oil is produced, third quality and black.

Whales afford an industrial occupation at Hammerfest.

The day before the arrival of Monsieur Labonne, the fishermen had caught a whale without trouble. The creature had stuck in a small creek which made a sort of natural trap, and it was unable to regain the open sea. The captain was asked what might be the value of the fish; and he replied 6,000 crowns (£336). They begin with selling rather dearly the 600 or 700 fins or whalebones; then they make great profit out of the immense quantity of fatty matters contained in the huge creature. This fat, improperly called oil, is naturally liquid, and is used for dressing skins. Beside the oleine, margarine, and phoceine, there is a volatile principle of the odor of leather, which gives the latter its characteristic smell.

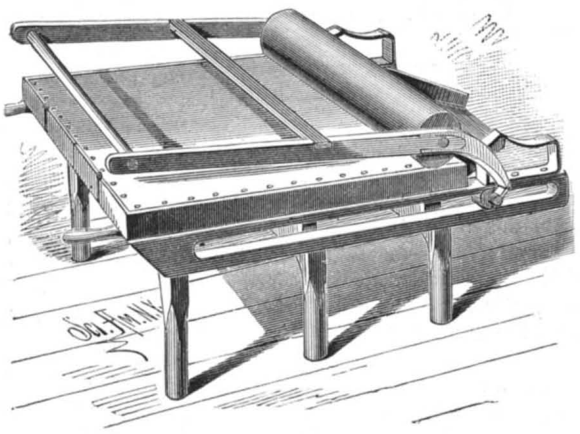
Turning to quite a different train of ideas, there is a monument at Hammerfest erected to the memory of Struve, who measured an arc of meridian from Ismail on the Danube to the frozen ocean precisely at this spot.

Farther north all cultivation disappears, and tree vegetation ceases—nothing but an underwood of stunted birch and willow.

Fish, even the largest, is caught with extreme ease; the large red hooks are scarcely plunged into the water than up comes an inhabitant of the sea, not a miserable specimen, but weighing some pounds at least.

MACHINE FOR WORKING BUTTER.

Upon each side of the stationary portion of the working platform, which is fastened to the middle of a common frame, are hinged parts that have handles at the outer back corners to aid in raising them when it is desired to throw the butter on to the middle of the table. When the leaves are open, the top of the table is a plane surface with a slight incline forward to carry off the water from the butter; and to prevent the water running over the edges, small grooves are made near the edges of the leaves. The connecting arms are made of iron, one end being firmly bolted to the levers and the other end being provided with a roller which travels in a groove in the side of the frame. The levers carry the working roller. This construction of the lever admits of a



WASSON & HITT'S MACHINE FOR WORKING BUTTER.

free motion backward and forward, or upward, at the option of the operator. A sheet of white cambric or flannel is fastened over the entire table.

The machine is operated by placing the butter in the center of the table, and then working the roller backward and forward by means of the lever handle. When the butter has worked its way nearly to the outer edges, it is thrown back upon the center of the table, by first raising the lever out of the way and then lifting the side leaves.

This invention has been patented by Messrs. J. Wasson & R. T. Hitt, of La Porte City, Iowa.

IMPROVED SAW ARBOR.

The engraving represents a cheap and effective device for holding circular saws for the purpose of jointing, setting, and filing them. The saw arbor or mandrel is journaled in bearings on a suitable frame, and at one end is made cone-shaped as shown. A corresponding hollow cone and shaft fit over the arbor and cone; the hollow shaft being of less length than the inner one. When it is desired to clamp a saw upon the arbor, the hollow cone is removed, and the hole in the saw placed so as to rest upon the face of the cone when the hollow cone is replaced and its end pressed against the face of the saw. The sleeve is then washered up

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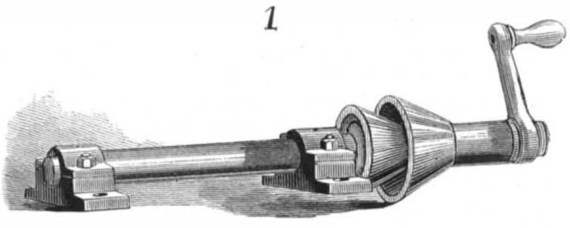

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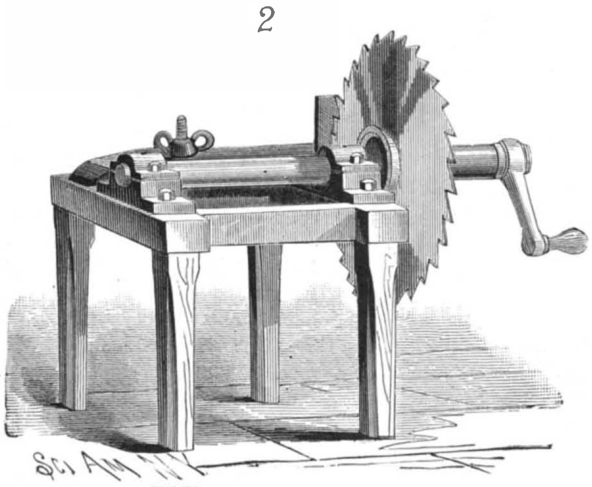


HACKET'S IMPROVED SAW ARBOR.

until the washers abut against the nut on the end of the shaft. Upon tightening the nut the saw is pressed against the cone and held firmly in place. Means for revolving the arbor, either by pulley or crank, are provided. The file is carried upon the end of the upper of two cross bars, which are adjustably clamped upon the upper and under surfaces of the side bars of the frame by a bolt and nut, as shown in the perspective view. With this device saws having eyes of different sizes, from the diameter of the shaft to the greatest diameter of the cone, can be held securely in place.

This invention has been patented by Mr. T. N. Hacket, of Emporium, Pa.

Electricity and Vital Power.

If we wish to judge of the electrical condition of the atmosphere, we do not examine for that purpose a paving-stone, the trunk of a tree, or the surface of a lake. They undoubtedly experience the effects of the changes for which we are looking, but they are not fitted to show them, and we select instruments which are *sensitive;* that is, those whose structure enables them to make manifest the changes as they occur. And we must apply precisely the same method of common sense if we would fairly learn how real and decided is the effect of atmospheric electricity on human health. We are well aware that the degree of individual susceptibility to the influence of external causes varies most remarkably, and this is true of morbific causes as fully as of any others. The "seeds of disease," to adopt a popular term (whether we accept the *germ theory* or not), are floating about us in myriads without number, and are inhaled by us with every breath, and yet the diseases are manifested only here and there, wherever the "seed" finds a susceptible point for its growth. In the same manner, though the electrical influence may come alike upon all, yet is its effect made manifest to us in certain cases with great power, while in others we fail to detect it.

Inasmuch as the two forces have so much in common, it is reasonable to infer that any disturbance of the nerve force should be greatest and most easily seen and measured where the vital powers were in an enfeebled condition, and most strikingly of all where the nervous system itself was in an irritable hyperæsthetic state; and this is precisely what is noted in constant clinical observation. Every physician whose line of practice brings under his charge many patients suffering from depression of nerve force, that which is of late recognized as *neurasthenia*, sees daily proof that they are more sensitive to electrical changes than any electrometer. The approach of a thunder shower is felt and mentioned by them often twelve hours or more before its arrival. Sometimes it causes an intense pricking and tingling of the skin, "like ten thousand needles," as they express it. Not unfrequently it induces active and even violent disturbance of the bowels, which will not subside without assistance, even after the cause has passed away.

Very often, in those hysterically inclined, it brings on hysterical unconsciousness, lasting many hours. And where no physical demonstrations occur a heavy mental depression, what they often term "a fit of the blues," gives evidence that the electrical force is bearing down the nerve force sadly. And it must be noted that these effects are not to be confounded with those produced by fear of the thunder; to those we make no reference.

Still again, without any electrical display in the form of lightning and thunder, there often come similar conditions of the atmosphere, continuing for, it may be, many days, and during the whole of that time every nervous patient is under a burden, though commonly ignorant of the true cause, and disposed to attribute such bad feelings to this thing or to that, as may be, and to try the patience not a little of friends, and perhaps of the physician, unless he recognizes the truth.

We set forth this class of sufferers as the nerve-electrometers, only because they manifest the changes so conspicuously. But whenever the vital force is enfeebled by specific or organic disease it is entirely easy to see how powerfully the electrical conditions of the atmosphere may intervene to determine the probabilities of life or death. When the power of life is barely able to hold its own in the struggle, a very slight cause of depression may be sufficient to turn the scale, and death will be the result; and it is sure that we have in atmospheric electricity a force which is capable of producing that result.

We have thus far been discussing only one side of the question, but very fortunately there is an opposite influence. Those degrees of tension which are seeking relief by discharges more or less violent, we have seen to weigh heavily on the vital force, but the stages of greater equilibrium show, as we might expect, precisely antagonizing effects. Even those of us who are in perfect health notice it. We say that the air is "bracing," etc., and it is perfectly sure that the sensitive, hyperæsthetic patients, of whom we have been speaking, respond to the influence, and the physician on his rounds learns to expect it, and is not disappointed as he finds one after another of them, like an old-fashioned weather-glass, pointing to "set fair."

No sufficiently extended observations are as yet on record to enable us to judge how closely the condition of atmospheric electricity is associated with the spread and continuance of epidemics of various diseases. That is yet to come.

W. O. A.

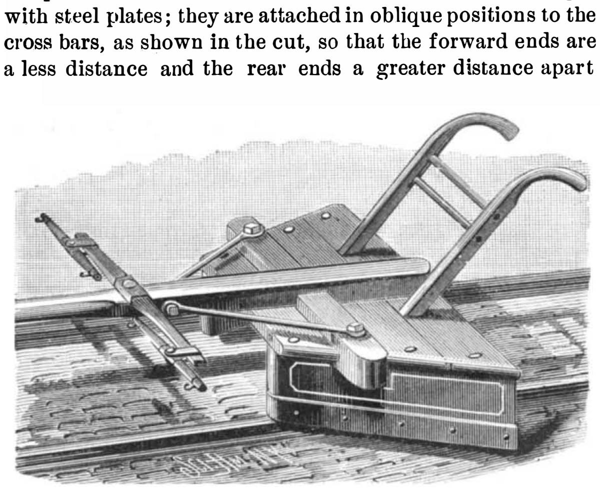
[Our correspondent makes some very strong assertions; but he fails to present any evidence for the support of his electrical theory. Our impression is the humidity, varying pressure of the atmosphere and fluctuations of temperature, would account for nervous disturbances better than the theory of atmospheric electricity.—EDS. S. A.]

Successful Men.

In every class of business the princes of the trade are the men who began with nothing, and who look around on all the attainments of their age with the honest gratulation that they have been dependent for their success and prosperity upon their own integrity, fidelity, and skill. And the circumstances of the commencement of active business life should not be regarded as a reason for regret or a cause for sorrow, for there is no other process less painful or harassing which will so surely stir up the gift which may be in a man, and bring out for circulation and use the veins of gold which may be embedded in his hidden mines. If he be faithful, honest, honorable, his early straitness of condition will be an everlasting blessing. It is a soil that will yield to appropriate cultivation the richest and most lavish fruit. But it will involve care, thought, labor, purpose, and unshrinking honor to prevent its becoming not merely a perplexity in occupation, but a poison to the soul.—*U. S. Economist.*

CAR TRACK CLEANER.

The device herewith shown is for clearing snow, mud, etc., from horse car tracks, and was recently patented by Messrs. J. G. Holden and J. E. Coe, of Danville, Ill. The scrapers are made of wood and are shod at their lower edges with steel plates; they are attached in oblique positions to the cross bars, as shown in the cut, so that the forward ends are a less distance and the rear ends a greater distance apart



HOLDEN & COE'S CAR TRACK CLEANER.

than the rails. To the rear are secured handles by which the cleaner may be placed upon and guided upon the track. The tongue which carries the ordinary whiffletrees for attaching the team to the cleaner is secured to the heavy cross bar and is braced by rods.

The cleaner is to be used after an ordinary snow plow has been passed over the track, and while being drawn along the track it will be so guided by a person at the handles that the shoes will run fairly upon the heads of the rails. The shoes are made thin and sharp, so that they will effectually remove all snow and ice.

THE ALLEN DENSE AIR ICE MACHINE.

The many advantages which the use of air presents in the working of ice machines have for a long time led inventors to seek a means of applying it without incurring the large losses which have heretofore accompanied its use. These losses were due primarily to the low specific heat of air compared with other cooling gases or vapors, and in consequence thereof the machinery required was large and wasteful of fuel, on account of the large volumes of air required to produce a given cooling effect. In the old form of machines the air was taken at ordinary pressure, compressed, cooled, and re-expanded to ordinary pressure, at which it circulated in the cooling pipes. It will be readily seen, however, that the greater the heat-absorbing power *per volume* of the cooling medium, the smaller will be the volume required to produce a certain amount of cooling effect, and consequently the smaller will be the machinery required to compress and circulate that volume. Since, however, the weight and consequent heat-absorbing capacity of a cubic foot of air at a tension of four atmospheres is four times that of a cubic foot at one atmosphere pressure, it follows that by circulating air at the former tension only one-fourth the volume will be required to do the same amount of cooling.

This latter fact is the basis of Mr. Leicester Allen's machine, for while heretofore air machines have circulated air at or near one atmosphere pressure, the former circulates air at a density of four atmospheres. This obviously gives the machine a great advantage over the older forms, and for the same work enables a machine to be used of only one-fourth the size of those in general use.

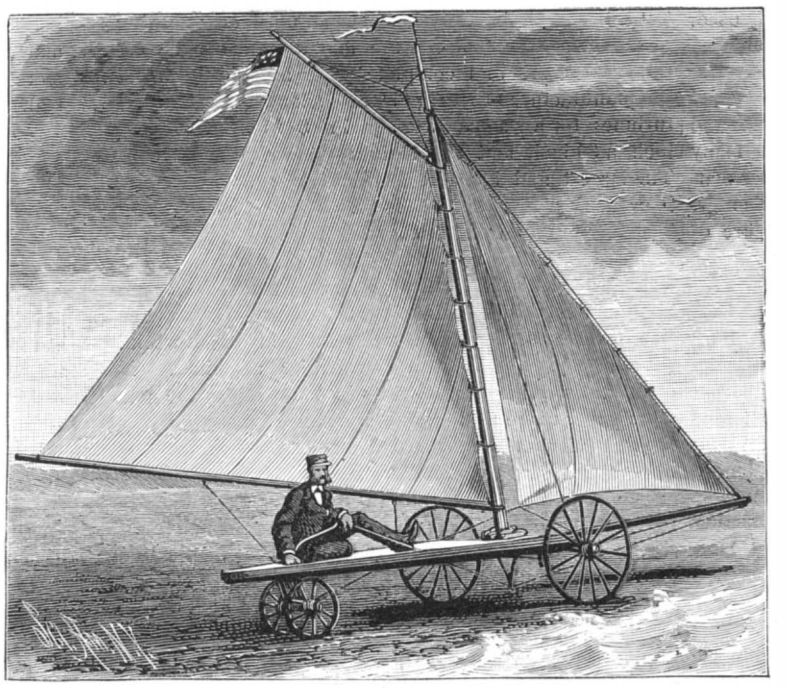
The accompanying illustration shows a perspective view of a four-ton machine. It will be seen to be mounted entirely on a single bed plate, thus greatly economizing space. On either side, at the rear, are situated cylinders, one being the steam cylinder, the other the expanding cylinder. Between these two the air compressor is placed, on both sides of which will be seen two small cylinders, the air and water pump, respectively. Above all these stands the large horizontal cylinder, through which water is circulated to cool the compressed air which passes through it in coils. The pistons of the compressor, pumps, and expander are directly connected with the crank shaft driven by the steam engine, as shown, thus giving them a positive motion.

The operation of the machine is as follows: We will assume that the pressure throughout the machine and cooling system is at ordinary atmospheric tension, and the steam engine started; immediately the small air pump at the side of the large compressor begins to force air into the system until a pressure of four atmospheres is reached, when a valve closes automatically and maintains the air in the system at that pressure. This dense air is now conducted into the compressor and compressed to 0·45 of its volume, or to a tension of twelve atmospheres. This heats it, and in order to lower its temperature it is led through coils into the large surface cooler, where the circulating water abstracts its heat and reduces the volume to one-third the initial volume. When cooled, the compressed air is led into the expanding cylinder, re-expanded to four atmospheres pressure, which lowers its temperature, and is then forced out into the circulating coils to cool surrounding objects. This process is a continuous one, and takes place in a closed cycle, no new air being admitted except to replace that lost by leakage, which amounts to an exceedingly small quantity. When it does occur, the valve of the air pump opens a trifle and admits just enough air to keep the pressure up to four atmospheres, when it again closes. By employing a closed cycle in operating the machine, several inconveniences and losses incident to air machines are avoided.

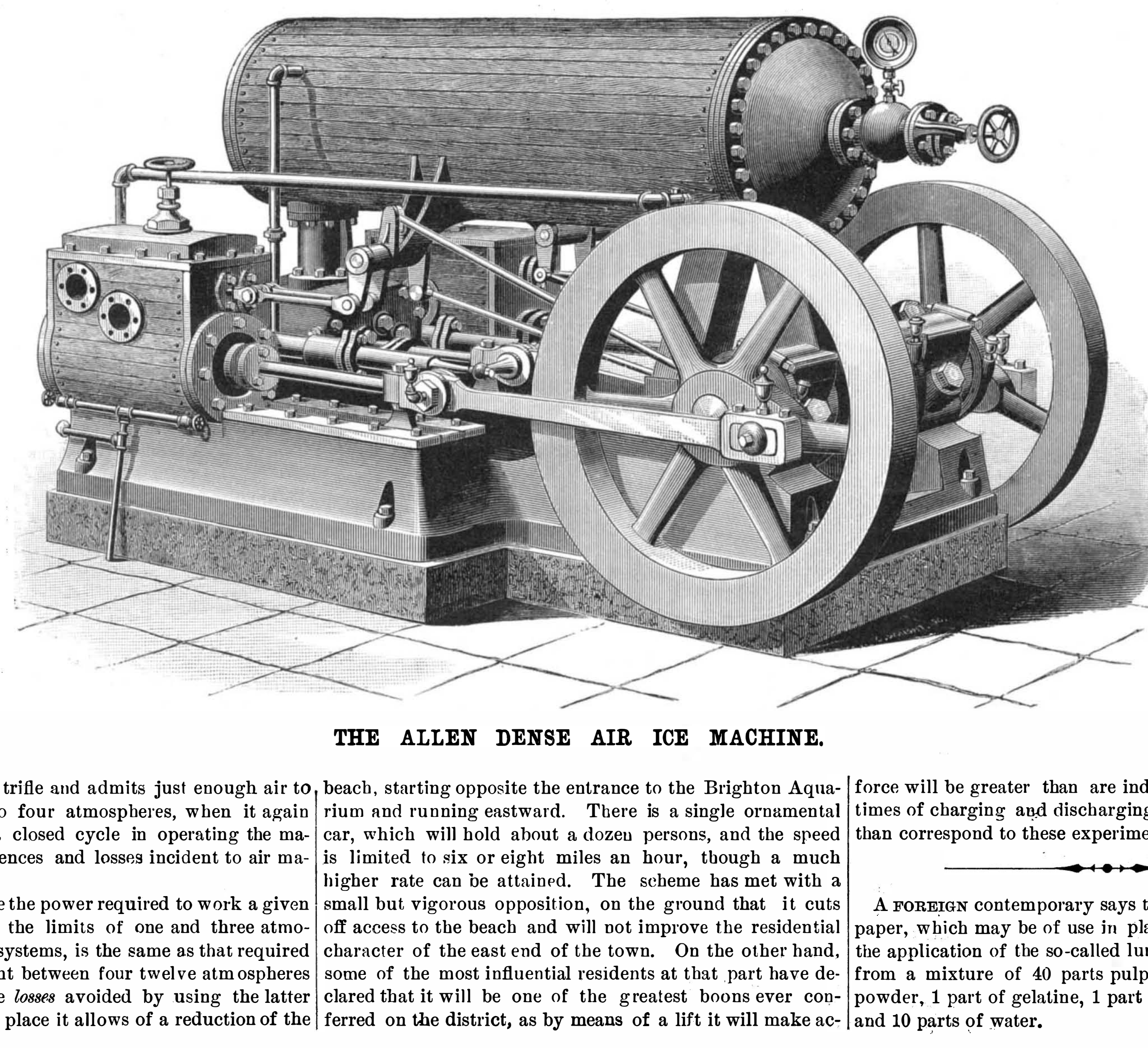
It is evident that while the power required to work a given weight of air between the limits of one and three atmospheres, as in the older systems, is the same as that required to work the same amount between four twelve atmospheres in the new machine, the *losses* avoided by using the latter are several. In the first place it allows of a reduction of the compressor and expander to one-fourth of their ordinary size. As a result, the surface losses within the cylinders, radiation, etc., are proportionally reduced; while the passive resistances, such as friction, are reduced very nearly in the same ratio. The machine, which we saw in operation requires no more care or attention than an ordinary etsam engine, and when once adjusted will run indefinitely without the necessity of watching.

During one hour of working the temperature of the air delivered at the exit pipe fell from 84° Fah. to —30° Fah., after passing through three-fourths of a mile of piping contained in an ice maker and cool room. It is claimed for the machine that it produces a cooling effect of somewhat over five pounds of ice melted per pound of coal consumed, which efficiency is more than double that of any other machine using air as a refrigerating medium, and the claim, though high, is well within the bounds of possibility.

One of these machines has been in practical use for over six months, and has required no repairs whatever, while two others will shortly be placed in the yachts of Mr. Wm. Astor and Mr. Elbridge T. Gerry. Further information can be obtained of the Allen Dense Air Ice Machine Co., Delamater Iron Works, West 13th Street, N. Y.



ASPINWALL'S SAIL WAGON.



THE ALLEN DENSE AIR ICE MACHINE.

An Electric Railway at Brighton, England.

The first journeys were made April 7, on an electric railway about a mile long, which, with the sanction of the Town Council, has just been constructed at the edge of the beach, starting opposite the entrance to the Brighton Aquarium and running eastward. There is a single ornamental car, which will hold about a dozen persons, and the speed is limited to six or eight miles an hour, though a much higher rate can be attained. The scheme has met with a small but vigorous opposition, on the ground that it cuts off access to the beach and will not improve the residential character of the east end of the town. On the other hand, some of the most influential residents at that part have declared that it will be one of the greatest boons ever conferred on the district, as by means of a lift it will make access from the sea to the cliffs easy, and give pleasant communication with the center of the town. Approach to the beach is not stopped, as the line can be stepped across at any point. The car runs almost noiselessly, and is worked by a stationary engine, which sends a current along the metals.

SAIL WAGON.

Across the wide forward end of the triangular frame extends an axle to which wheels are journaled. The short axle of the rear wheels is pivoted by a kingbolt to the narrow end of the frame. To the short axle is attached a gear wheel into which meshes a smaller wheel secured to the lower end of a vertical shaft journaled in bearings fastened to the frame. Upon the upper end of this shaft is a hand wheel or tiller, by means of which the wagon may be guided. The speed of the wagon is regulated by brakes upon the front wheels, connected with an upright lever pivoted in the middle part of the frame and provided at its upper end with a crosshead, so that it can be operated either with the hands or feet. A mast fastened to the middle forward part of the frame is provided with a sail and appliances for raising, lowering, and controlling the sail in the same manner as an ordinary sail boat.

With this construction the wagon can be driven at great speed by the wind, and can be driven with, on, or against the wind, where the beach or road is hard, with as much effect as can a sail boat on the water.

This invention has been patented by Mr. J. A. Aspinwall, of Bay Ridge, N. Y.

Accumulators.

M. Reynier, the well known electrician, has made experiments on three systems of secondary battery: (1) The Plante accumulator of reduced lead, peroxide of lead, and sulphuric acidulated water; (2) the copper accumulator of lead, copper, lead peroxide, acidulated solution of sulphate of copper; (3) the amalgamated zinc accumulator of zincked lead, lead peroxide, acidulated solution. His object was to test the electromotive forces of the combinations, and find their variations of sulphate of zinc. The accumulators were not completely formed. The electromotive forces were measured during charge and discharge by the method of equal deflection. His results confirm those formerly obtained by M. Gaston Plante, and are as follows:

(1) In the three systems of accumulators studied, the secondary electromotive force is notably more elevated during charge than during discharge. The ratio of the smallest of these values to the greatest may be called the *coefficient of fall*. It is a factor of loss which affects the efficiency of accumulators. (2) The fugitive superelevation of the electromotive force increases with the intensity of the charging current and the electromotive force of the source. (3) In the Plante accumulator the electromotive force is at least 1·95 volts during the charging, and at most 1·85 volts during the discharge. The coefficient of fall is therefore 0·95 under the most favorable conditions. (4) In the copper accumulator the electromotive force is at least 1·43 volts during charging, and at most 1·25 volts during discharge. The coefficient of fall is therefore 0·87 under the most favorable conditions. The copper accumulator is that which loses most. (5) In the amalgamated zinc accumulator the electromotive force is at least 2·4 volts during charging, and at most 2·36 volts during discharge. The coefficient of fall is 0·983 in the most favorable conditions. The amalgamated zinc accumulator is that which loses least. (6) In practice the losses due to variations of electromotive force will be greater than are indicated above, because the times of charging and discharging are generally more rapid than correspond to these experiments.

A FOREIGN contemporary says that a luminous waterproof paper, which may be of use in places not well adapted for the application of the so-called luminous paint, may be made from a mixture of 40 parts pulp, 10 parts phosphorescent powder, 1 part of gelatine, 1 part of potassium bichromate, and 10 parts of water.

AMERICAN INDUSTRIES.—No. 91.

[SEE FIRST PAGE.]

THE MANUFACTURE OF FINE PRINTING PAPERS.

In no other department of industry have there been more marked advances in recent years than in the manufacture of paper. Modern printing presses, and a society of which nearly all are large readers, as well of tastily printed books and periodicals as of the daily papers, have increased the demand many fold within the present generation. It would have been impossible to meet this greatly enlarged call for paper if it were all manufactured of rags, as was the case a few years ago, and to use the cotton, flax, etc., in their raw state would have made the product very expensive; therefore, in this country, wood has been largely used, either in connection with rags or alone for the cheaper grades, and in England the Spanish esparto grass has, since 1856, furnished a very large proportion of all the paper stock. Materials of which paper can be made are found in nearly all vegetable life, but the cellulose is in many cases so intimately associated with coloring and other matters as to require the use of expensive chemicals, while rags, having been originally purified during the manufacture of the cotton and flax, yield a large percentage of fiber with comparatively little cost for chemicals. They give a very pure white with exceedingly strong fiber, and are used alone for only the finest qualities of paper, although pulp from inferior fibers is often mixed therewith in making medium grades of paper. Of the wood used in paper making poplar is most esteemed, as it gives a very white fiber; pine gives a long and strong fiber, but the wood has so much resinous matter that it requires stronger chemicals and more work to fit it for the paper machine. The manufacture of paper pulp from wood is principally confined to the United States and Sweden, though wood pulp is somewhat used by English and European paper manufacturers.

In practical paper making the assorting and dusting of the rags is the first step. They come in great variety, differing according to the locality where gathered, and are divided into many classes and grades, this market receiving many from the Baltic and Mediterranean ports. When stored in large quantities great care should be taken that they are perfectly dry, many fires having occurred from the heat developed by the slow decomposition of rags stored in a damp condition. The sorting of the rags is necessarily done by hand, but cutting them up into pieces about two by five inches or less is now done principally by machine. Both before and after the sorting they are passed through thrashers or dusters, which beat the rags and drive the dust through wire gauze partitions.

The boiling, which comes next, may be done in various kinds of vessels, but a horizontal cylindrical boiler, which revolves, gives a more perfect circulation of the liquor, and is generally preferred. The chemical used is lime, carbonate of soda, caustic soda, or a mixture of the two former, which is equivalent to the latter. The quantities used, as well as the pressure and time of boiling, vary with the quality of rags, and afterward the rags must be thoroughly washed, which is effected by running on water, and with more or less pressure of steam. The breaking and washing usually require from two to four hours, and the machinery therefor is represented at the right in two of our first page views.

The bleaching may be effected with a liquor made by dissolving bleaching powder in water, although bleaching with gas and sour bleaching are sometimes followed, but, whatever the method adopted, any excess of bleaching agent must be got rid of.

The sizing is effected by the precipitation and intimate mixture with the pulp of a substance which will, when dry, to some extent fill up the interstices between the fibers of the paper, and which will not readily take up water. Common resin and alumina, with carbonate of soda, through the medium of a resin soap, make a mixture which may be thoroughly incorporated with the fiber, and it is here that a small quantity of china clay is added, for some qualities of paper, to close up the pores and enable it to take a good surface, such addition, to the amount of five per cent, not being considered detrimental, while more than that would weaken the fiber.

The Fourdrinier paper machine, of which several may be seen in the large view near the middle of the page, forms in itself one of the best representations of the high attainment reached by modern mechanical skill. Improvements have been steadily made in it through many years, for the better working of different kinds of pulp, and the making of a greater variety of product, but the original features of its construction have been maintained. The pulp is fed to it over sand tables and strainers, to remove lumps and imperfections and separate the fibers, then to an endless cloth of very fine wire carried by a large number of small rolls, the wire cloth also having a shaking motion from side to side to weave and intertwine the fibers; thence it passes to an endless felt, traveling over rolls, and between press rolls, till the water is so taken out and the fiber knit together that it can be passed over drying cylinders and between heated and polished rolls for surfacing and calendering. There are, of course, many different modifications of machines, the details being variously contrived for the best results in different kinds of work, but these are the essential features in all of them.

The calendering machines, a view of which is given at the bottom of the page, are for the purpose of giving a hard finish, the paper being here passed around steam heated cylinders and rolls, where powerful pressure can be applied.

The Jessup & Moore Paper Company, whose establishments furnish the subjects of our illustrations, have four paper mills, the Augustine, the Rockland, the Delaware, and the Chester, the two former being on the Brandywine, near Wilmington, Delaware, the Delaware mill on the Christiana River, and the Chester mill near Coatesville, Pa. In selecting a site for a paper mill, it is absolutely requisite to obtain one which shall have an abundant supply of pure water, not only as a matter of economy in working, but fine paper cannot be made at all with the water found in many localities. In respect of this prime essential, these mills have exceptionally advantageous locations.

The Augustine mill was the first built and run by the firm, but it has been successively changed until now nothing remains of the original structure, and it stands to-day one of the most costly and complete paper mills in the world for the manufacture of fine grades of book paper. It has Jonval turbines for a water power equal to 300 horses, besides a 20 inch, a 30 inch, and two 15 inch cylinder Corliss engines. The largest and heaviest leather belt ever then sent from New York was furnished for this mill about five years ago. The engine room forms a striking feature of the establishment. The entire mill is of stone and iron, fireproof, and lighted by electricity, and all the machinery is of the latest and most improved description, the engines for the preparation of the stock being of iron, and there being at work here two 90 and one 76 inch Fourdrinier machines. Many of the most artistic publications in the country are printed upon paper made at this mill, and it has for years furnished the paper for the SCIENTIFIC AMERICAN. The capacity of the mill is 30,000 pounds a day.

The Rockland mill, built in 1860, was designed for the manufacture of newspaper, and was among the first to utilize the process of making printing paper from chemically prepared straw pulp. Reconstructed, after a fire in 1864, of stone and iron, its capacity was greatly enlarged, the straw process abandoned, modern machinery introduced, and good grades of paper for book work and weekly newspapers have since been made. Besides the water power furnished by Jonval turbines there are employed here two 20 inch and a 16 inch cylinder Corliss engine, and one 28 inch cylinder Babcock engine. Three Fourdrinier machines are used, one 74 inches and two 86 inches wide, and the product is 26,000 pounds of paper a day.

The Delaware mill has a production of 32,000 pounds a day, and the Chester mill 8,000 pounds daily, and both are completely equipped with the best modern appliances.

The firm of Jessup & Moore was organized in 1843, by Augustus E. Jessup, of Westfield, Mass., and Bloomfield H. Moore, of Philadelphia, and the corporation of the Jessup & Moore Paper Company was organized December 1, 1878, its officers consisting of C. B. Moore, President; D. W. Evans, of New York city, Vice-President; F. W. McDowell, Secretary; and J. R. Moore, of New York, Treasurer—under whose management the business is still conducted. The business offices of the house are in the Bennett Building, New York, and 28 South Sixth Street, Philadelphia.

The history of this house has been in a marked degree typical of the progress of paper making for the past half century. It has kept fully abreast of the times, and its exhibit of cellulose at the last Paris Exposition was a great surprise to the papermakers of Europe, showing, as it did, that American paper manufacturers were decidedly in advance of their European competitors in the utilization of new raw materials in the manufacture.

Death of a Pioneer in Machine Shoemaking.

Mr. Edwin C. Burt, the widely known New York shoe manufacturer, died at his home in Orange, N. J., May 23, 66 years of age. It is doubtful whether any other manufacturer in this business ever attained the wide reputation which he achieved, in a short space of time, from the success with which he employed the sewing machine in making the finest grades of ladies' shoes. Previous to 1862, when machinery began to be introduced generally in shoe factories, it was not thought possible to make fine goods in this way, but Mr. Burt bought the finest kids and the best sole leather, employed a high class of workmen, and then, himself superintending the work, used machinery to make a finer class of goods than had ever before been offered as ready made, and which was rarely equaled in the best handmade goods. The success which attended his efforts did much to hasten that industrial change from which it now appears that about nineteen-twentieths of all the boots and shoes worn in the country are factory made, and the "bespoke" shoemaker of the olden time has almost gone out of existence.

Annual Convention of Civil Engineers.

The American Society of Civil Engineers will hold its annual convention for 1884 at Buffalo, N. Y., June 10th to 13th. A special train over the New York, West Shore, and Buffalo line will convey members from this section. Reports are expected and discussions will be had on "Standard Time," a "Uniform System for Tests of Cement," the "Preservation of Timber," and other topics.

AN illustrated article on paper making machinery, as manufactured at the Pusey & Jones Works, at Wilmington, Del., will appear in the SCIENTIFIC AMERICAN in next issue.

Science and Manufactures.

There was never perhaps a time when the special industries of England were more depressed, or their outlook more gloomy. The fact that the steel rail makers of England have banded themselves with those of France and Belgium into an association for the maintenance of remunerative prices speaks volumes, not only as to the severity of competition, but as to the sources from which that competition comes. On the other side we see the ironmasters of America extending their output year by year, and her manufacturers entering into competition with us in neutral markets, while jealously excluding us from their own.

What is to be the remedy for this state of things? How is the demand for manufactured articles, and for the raw materials out of which those articles are made, to be once more equalized with the supply? Unless some vast market, such as China or Central Africa, can be opened up to European commerce, the only chance seems to lie in a new departure; in some great cheapening of production, or cheapening of transport, comparable to that which was effected by the development of railways. Now, what is the physical fact lying at the basis of railway locomotion? It is simply this, that iron laid in the form of a track offers a resistance to rolling which, as compared with an ordinary road, is insignificant, while at the same time it offers a resistance to sliding large enough to utilize to the full the vast tractive power of the modern locomotive. The first point had long been known; the second was seized by the practical genius of George Stephenson, and enabled him at once to solve the problem of high speed locomotion. In so doing he owed nothing to science; but science might have discovered the fact, and would have done so with small trouble, if the idea had been put into her head—if, in fact, there had been in England that union of theory with practice which it is our present aim to advocate.

What is wanted now is that science shall point out some other fact of nature, new or old, which practice may seize upon, turn to her own ends, and make the basis of some new industrial development. It is easy to indicate various directions which such a development might take. Thus there is great need of some system of light railways which can be laid down on ordinary roads, and so cheaply that the traffic available on such roads may be sufficient to pay a fair return on the capital. It is impossible to calculate the advantages which would spring from the wide extension of such "third class railways," as they are called in Germany. Again, the storage of power, such as that of the tidal wave, with cheap and ready means for giving it out when and where it is needed, offers a wide field for invention, and may lead to the most fruitful results. The transmission of power to long distances, whether by electricity, compressed air, or otherwise, is a somewhat similar problem, which at present occupies the attention of many engineers and men of science. Lastly, the more homely subject of house building offers at this moment special inducements to constructive genius. If houses could be built, by the use of iron or otherwise, at, say, half their present cost, the problem of sheltering our poor would be solved; unsafe and ruinous tenements would disappear, and a demand would set in for building materials and labor such as the world has never known.

Here, however, the question arises, Supposing that science and art should combine successfully for any such purpose, is it in England that the development will take shape?

At the time of the last industrial epoch, that of the introduction of railways, it would have been safe to prophesy that this would be the case. It is by no means so certain now. As regards cheap transport, for instance, the most promising recent invention in this field, viz., the caustic soda condenser previously described by us, was brought out in Germany. Other improvements in the same field, such as the portable railways of De Cauville, the rack railway of Riggenbach, the cable tramway of Hallidie, the fireless engine of Francq, the iron sleepers which are rapidly becoming universal in Germany, have all taken their rise either on the Continent or in America. The storage of power, in its only practical form, that of the secondary battery, owes its origin to Plante and Faure. The transmission of power is being worked out by Siemens in Berlin, and by Deprez and Tresca in Paris. Lastly, as to building, no one can travel abroad without seeing that as regards scientific architecture England stands far nearer the bottom than the top in the scale of civilized nations.

What is the reason of this? Why is England thus lagging behind in the race? The answer is not far to seek. In America, in France, above all in Germany, the union between science and art is far more close and cordial than with us. Every practical constructor or manufacturer is anxious to know all he can of science, every scientific professor desires to mix practice with his theory. Thus on the one hand we find ordinary engineers drawing on all the resources of mathematics for the solution of such problems as the proper sections of rails or the resistance of trains; on the other hand we see Clausius, perhaps the greatest of German physicists, devoting two long papers to investigate the working theory of the dynamo machine. But a concrete instance will make our meaning clearer. Within the last few days we have inspected a safety lamp, of which some thousands have already been sold for the German mines. It has many points of excellence, but we need only dwell upon one. It is well known to be most important that a miner's lamp should be locked in such a way that he cannot, if he will, open it; and it has been found very difficult to provide any simple kind of lock which it is beyond the resources of a clever workman to tamper with. In this lamp the difficulty is got over by making the upper part screw into the lower, while inside the lamp there is a catch or pawl, which, as in a common ratchet, prevents the screw from being turned the opposite way. Hence, that the lamp may be unscrewed, the pawl must be drawn out of place. In the overseer's office this can be accomplished by means of a powerful horseshoe magnet. The pawl has a tail, which is attracted by the magnet when the latter is placed in contact with the side of the lamp. The tail moving toward the magnet, the pawl moves in the opposite direction, and so allows the upper part of the lamp to be unscrewed, while the lower is held as if in a vise by the same magnetic power.

Now, here we have a simple and beautiful contrivance for effecting an important practical object. It is merely the application of a well known scientific principle to solve a special problem in construction ; but it never could have been invented except by one to whom the resources of science and the needs of art were equally familiar—who was at once a physicist and an engineer. Now, it cannot be questioned that in England we can boast many of the highest authorities in science, many men of the highest skill in practical construction; but the union of the two is comparatively rare, and yet it is this very union—the application of the scientific spirit to the things of common life—which is the vital necessity of the age.

We by no means wish to imply that no progress is being made in the direction here pointed out. The work undertaken by the City and Guilds Institute, the foundation of scientific colleges, such as those at Birmingham, Sheffield, Leeds, Nottingham, and elsewhere, the appointment of a Committee on Technical Education, the delivery of scientific lectures at the Institution of Civil Engineers—these are all signs that the gap existing between art and science is at last recognized, and that endeavors are being made to draw them together. Moreover, the old "rule-of-thumb" engineer is rapidly passing away, and a new generation is springing up, who, if they do not possess much science themselves, are at least alive to its value. The testing machine, for instance, is becoming a recognized institution in large workshops, where not many years ago it would have been scouted as absurd. In the skillful hands of a practical engineer, Mr. Wicksteed, of Leeds, it has been made to record its own variations of stress by a self-drawn diagram, and this record seems likely to throw fresh and unexpected light on the physical problems of extension and rupture. The same gentleman has both discovered and applied a new and most remarkable phenomenon in friction; the fact, namely, that if we give a rotary motion to a body which is in contact with another, not only is the friction diminished in the direction of motion, but the friction in the perpendicular direction is also diminished, apparently in at least an equal degree. Hence, for instance, by rotating the leather packing of a hydraulic ram, it becomes quite free to move in its cylinder in obedience to a difference in pressure on one side or the other. Here we have, once more, science helping art, and art in return throwing light upon the path of science.

These facts, and others like them, are encouraging signs, but we must repeat that something more than signs is needed. The work must be not only begun but finished, the bonds of union must be drawn close, and that quickly, or England will find that it is too late, and that she is once more ready to do the work of the world just when the world has left her no work to do.—*Nature.*

Opera by Telephone.

When the new opera "Lauriana" was produced recently for the first time, at the Lisbon Opera House, the King and Queen of Portugal were in mourning for the Princess of Saxony. The etiquette of courts prevented their royal highnesses from attending, and their despair thereat added to their grief at the loss of the Princess was like to have overwhelmed them. If Mohammed could not go to the mountain, the mountain must come to Mohammed. And so he brought the opera to their royal highnesses—by telephone.

Six microphone transmitters were placed about the front of the operatic stage in multiple arc. They were mounted on lead and soft rubber pedestals to prevent disturbance from the vibration of the building. Each transmitter was fed by three sets of batteries, which were switched on every twenty minutes in succession to keep on the current strength. There were receivers at the palace end for the use of the royal family, who thus heard the opera from beginning to end.

Germs at Sea.

It has generally been thought, and direct observation has confirmed the notion, that the air above the sea is singularly free from the low forms of organic life. MM. Moreau and Plantymansion have taken advantage of their leisure during a voyage in the Gironde from Rio de Janeiro to Bordeaux to obtain some data bearing on this question. They have found that over the open sea, at a distance from the vessel, the air contained very little solid matter. The land breezes appear to become rapidly free from the multitude of organisms which they carry with them from populous districts. M. Miguel, of the Montsouris Observatory, regards the fall of germs into the sea as a reassuring fact; breezes blowing from the distant continents, which might otherwise bring epidemics with them, become purified, it is supposed, in crossing the ocean. The gentlemen above named have found that the atmosphere immediately about the vessel practically swarmed with micro-organisms; the vessel seemed to be surrounded by an "atmosphere of microbes."

Correspondence.

Illustrations of Electrical Phenomena.

To the Editor of the Scientific American:

Having occasion to illustrate in a lecture some of the phenomena of atmospheric electricity, I desired to obtain as long strokes as possible. With the apparatus at hand the longest stroke I could obtain in air was 4¼ inches. I tried iron filings sprinkled on varnished glass, paper, and wood, but the results were not satisfactory. After several experiments I hit upon the following exceedingly successful method:

I fastened dry boards together to make a plane surface, 4 feet long and 3 feet wide. One side of this I varnished, and before it was dry pressed over its entire surface sheets of tin foil. After letting it stand over night to dry slightly, with a ruler I passed a sharp knife across the foil in lines about one-eighth to one-quarter inch apart. Allowing it to dry again a short time, I passed the knife across it right angles

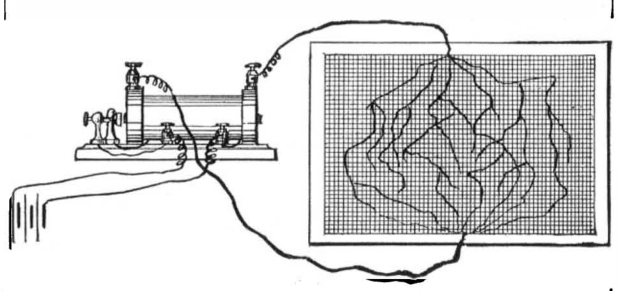


Fig. 1.

to the former lines, thus cutting the foil into squares, separated by very short distances—only the thickness of the knife edge. Connecting the poles of my coil to opposite ends of the board, a phenomenon of dazzling beauty was produced. Every time the circuit broke, from six to twenty streaks of lightning zigzaged from one end of the board to the other. These were exceedingly brilliant in the dark, when the circuit was broken only about 180 to 200 times a minute. Judging from the resistance of vacuum tubes placed in the circuit at the same time, I believe I can obtain strokes from 15 to 20 feet in length by this method, if the foil be placed in a narrow strip along a pole of that length.

The drying mentioned above is necessary, as it is very slow under the foil, and the strips will be pulled out of their places in the second cutting.

REYNOLD JANNEY.

Wilmington, O., March 16, 1884.

My coil is made on the same plan as that given in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 160, and contains about 30,000 feet of No. 36 naked copper wire. The circuit break is a combination of the ordinary platinum contact break and a mercury break, so that either can be used at will. The mercury break produces much better effects. It consists of a platinum wire dipping into mercury covered with alcohol.

The condenser consists of 40 sheets of tin foil, 6 inches by 12 inches, with varnished paper between.

The battery consists of three cells of the Grenet type, each containing about 50 square inches of zinc surface, counting both sides.

With this battery and coil I to-day obtained strokes in air 4½ inches long between a brass disk, 1½ inches in diameter, and a point.

Over a tin foil surface as described I obtained a stroke 10 feet long, with sufficient force to make it much longer had I had a greater length of tin foil.

There is one peculiarity about these strokes depending upon the connections. If the opposite ends of the board

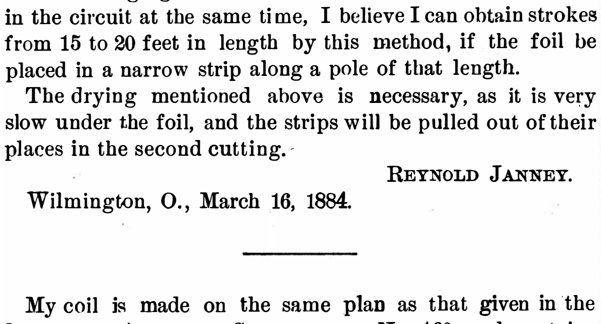


Fig. 2.

covered with the foil be connected directly with the poles of the secondary coil, the discharge seems to scatter over the whole surface, making several simultaneous strokes and producing a very beautiful appearance. (See Fig. 1.)

If the connections remain as in Fig. 1. but also the poles of the coil be connected one with the inside and the other with the outside of a small condenser containing about 4 to 6 inches of tin foil, the electricity no longer scatters over the board, but makes only one much more direct and more intense stroke. (See Fig. 2.)

REYNOLD JANNEY.

Wilmington, O., June, 1884.

Intermarriage of Cousins.

To the Editor of the Scientific American:

There is a popular belief that the intermarriage of first cousins is likely to produce offspring imperfect in intellectual or physical development.

Is this belief sustained by scientific observation and statistics? S.

[*Ans.*—The prevalent idea that the offspring of the intermarriage of first cousins are specially liable to be below the average intellectually and physically is not found to be sustained by good evidence. Mr. G. H. Darwin, in a very carefully prepared paper, before the Statistical Society of London, comes to the conclusion, as the result of close comparison of all the records available, that the evidence will not "enable any one to say positively that the marriage of first cousins has any effect in the production of insanity or idiocy. . . . With respect to deaf mutes, there is no evidence whatever of any ill results accruing to the offspring in consequence of the cousinship of their parents." And again, "It tends to invalidate the alleged excessively high death rate among the offspring of cousins." And once more, "The safest verdict seems to be that the charge against consanguineous marriages on this head is not proven."—EDS. S. A.]

Dangers of the Proposed Treaty.

To the Editor of the Scientific American:

I write to call attention to a great danger which hangs over the patent interests of the United States. It lies in the proposed new reciprocity treaty. The danger is just in this: There are a great number of patented machines making *goods* that are not patented. The patent is on the machine; remove the tariff, and what is to prevent the Canadians building the machine, and killing the patent. The Canadian patents have had but small value, for the conditions are not favorable to a numerous class of patents, such as are obtained to protect a line of manufacture which, from its nature, should be held in the hands of one party, so as to secure uniformity of quality and degree of excellence. This treaty will kill all such patents, to the injury of the public and to the ruin of those who, on faith in protection, have made large investments.

Any treaty entered into with Canada which virtually destroys protection obtained in good faith should not be entered into, and the foundation of such treaty should be founded upon a reciprocity of patent protection. R. T. SMITH.

Nashua, N. H., June, 1884.

Soda Water Profits.

Under the caption of "A Business that Pays," a large dealer in soda water apparatus thus enlightens the trade on "the profits which dealers in carbonated beverages may reasonably hope to make," which he says "can be readily inferred from the following accurate estimate of the cost of manufacturing each beverage." In the "dispensing department"—that is, selling from the fountain—the following are the actual costs:

One glass of plain soda water costs one-tenth of a cent.

One glass of soda water with sirup costs one cent and a half.

One glass of mineral water costs one cent.

One glass of root beer costs one cent.

One glass of ginger ale costs one cent and a quarter.

One glass of fine draught champagne costs four cents.

In the "bottling department" the following scale of costs, prevails:

Plain soda water, best quality, put up in bottles closed by corks and fasteners, costs eight cents per dozen.

Ditto, with gravitating stoppers, costs three cents per dozen.

Soda water, with sirup, in bottles closed by corks and fasteners, costs fifteen cents per dozen.

Ditto, with gravitating stoppers, costs ten cents per dozen.

Ginger ale, in bottles, with corks and wires, costs seventeen cents per dozen.

Ditto, with gravitating stoppers, costs twelve cents per dozen.

Mineral waters in siphons costs three cents per siphon.

Sparkling champagne (domestic), best quality, costs twenty-five cents per quart bottle.

From a simple comparison of the foregoing scale of costs, and the well known retail charges for the same articles, the inference drawn by the manufacturer, that it is "a business that pays," appears to be a correct one.

Then a list is given of the materials included in the outfit for this business. We find in this catalogue the following items:

Sulphuric acid and marble dust to make the carbonic acid gas, which gives the sparkling quality.

Chemical extracts for the flavors.

Coloring to imitate raspberry, strawberry, and other fruits.

Gum foam to give it an artificial foam, which enables the retailer to sell half a glass of soda as a brimming glassful.

Tartaric and citric acid to do duty for lemon soda.

Coloring for making something sold for sarsaparilla.

There is one item called an "acid dispenser," which appears to be essential in handling "acids and other corrosive" ingredients. We are not informed if such acids and corrosive substances are eliminated during the manufacture or during their passage into the human stomach. Such facts remain among the mysteries of "a business which pays."

French Academy Prizes.

In mechanics the extraordinary prize of $1,200, offered by the French Academy of Sciences, has been awarded in part to M. Taurine for his "Study of Marine Engines," in part to M. Germain for his "Treatise on Hydrography," and in part to M. A. De Magnac for his work on "New Astronomical Navigation." M. Taurine's book contains the results of numerous original experiments bearing upon the art of shipbuilding. M. De Magnac's new method of navigation is that suggested by Sumner, and practically tried by Sir W. Thomson several years ago. It depends on the fact that a knowledge of the hour of the first meridian at the moment when the altitude of a star is observed, enables the mariner to describe a terrestrial circle, on which the ship must necessarily be. By observing two different stars simultaneously, or very soon after each other, two circles are obtained, which at their intersection mark the position of the ship. This method has been adopted in the French navy.

The Montyon prize has been awarded to M. Leon Francq, civil engineer, for perfecting a fireless locomotive of the kind invented by Mr. Lamm, of New Orleans. The Fourneyron prize has been awarded to M. Marcel Deprez for his well known experiments on the electric transmission of power. The Lacaze prize has been bestowed on M. Henri Becquerel, the eminent physicist, for his researches on the magnetic rotation of solids in liquids and gases, and other valuable discoveries. The Lacaze (chemical) prize has been awarded to M. Cailletet for his researches on the liquefaction of gases. In aerial locomotion the Academy has awarded the Penaud prize in equal parts to M. Gaston Tissandier, M. Duroy de Bruignac, and M. V. Tatin. M. Tissandier's experiments on the application of electricity to ballooning are well known; M. De Bruignac has invented a compound aeroplane combining a small balloon with sheltering surfaces; and M. Tatin has modeled the helix used by Tissandier, besides constructing artificial birds which fly by actual strokes of the wing.

New Febrifuge—Kairin.

The reports of the remarkable antipyretic effect of kairin continue to augment. Most observers seem to agree that it is best to begin in adults with a dose of about 12½ grains, to repeat this two hours later, then to administer 9 grains every two to three hours, until the desired effect—decrease of temperature—has been obtained, when a smaller dose, about 5 grains, employed ever three hours, usually suffices to keep down the temperature. But at the least indication of the temperature falling below normal, the remedy must either be omitted or given in small doses and at very long intervals, say 3 grains every twelve hours. Should, however, the temperature nevertheless again ascend, the same course as described must be gone through anew.

Tamarinds.

There are but few people to whom the flavor of preserved tamarinds is not agreeable, but do those who frequently use tamarinds know how they are prepared? They come into commerce both from the East and West Indies; the latter, it would seem, are simply the fruits, or, rather, pods from which the shell or epicarp has been removed, and the pulp, together with the strong fibrous framework upon which it is built, and the seeds are placed in alternate layers with powdered sugar in a cask or jar, over which boiling sirup is afterward poured. In the East Indies it seems they are prepared by first removing the epicarp and seeds by hand, after which the pulpy portion is usually mixed with about 10 per cent of salt, and trodden into a mass with the naked feet. Of these tamarinds several qualities are known in the market, the best being free of fiber and husk, and the worst containing both, together with the hard, stone-like seeds, which are commonly eaten in the East Indies after being roasted and soaked to remove the outer skin, and then boiled or fried, when they are said to be tolerably palatable. West Indian tamarinds are alone officinal in the British *Pharmacopœia;* while on the Continent those from the East Indies are alone employed. Besides the tamarinds sent to Europe they are also shipped in large quantities from Bombay to Persia and other northern countries.—*Gardeners' Chronicle.*

PORTABLE ELECTRIC TESTING APPARATUS.

Electric light engineers often have occasion to ascertain the resistances of the machines and circuits with which they have to deal, under conditions which make it inconvenient to have at hand the comparatively cumbrous apparatus which is usually provided for the purpose. The instrument of which we this week give an illustration has been designed with a view to portability, and to enable it to be used without much time being lost in setting it up. It is made by Messrs. Latimer Clark, Muirhead & Co., and although the last and improved pattern is somewhat larger than that originally introduced, it is still of so small a size that electricians can easily carry it with them. The range and sensitiveness of the instrument are amply sufficient, and it is further capable of forming a useful adjunct to more delicate apparatus in the laboratory, seeing that it is always set up

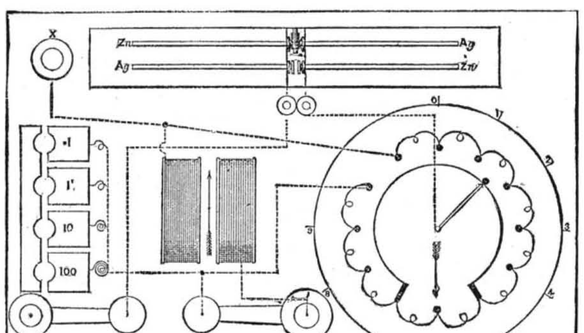


DIAGRAM OF CONNECTIONS.

ready for instant use, and that measurements can be made with great rapidity. To combine in such small compass so many different parts in a practical form, and to insure correct reading with the minimum of skill on the part of the operator, necessarily required some little evolution, yet the result has been obtained by taking advantage of known methods without embodying any new principle.

Chloride of silver elements, wrapped in blotting paper moistened with a solution of zinc chloride, supply the current. The galvanometer needle is astatic, suspended from a torsion head by a silk fiber, and can be set to zero without it being necessary to adjust the position of the instrument relatively to the magnetic meridian.

A single plug, which, when not in use, is placed in the cover as shown; serves to vary the comparison coils from 0·1 to 100 ohms. A battery and a galvanometer key prevent the extra current due to induction disturbing the balance.

The arrangement of branch coils, while, as in the ordinary "meter" bridge, permitting of continuous variation in values being read, provides a length of wire the resistance of which bears a due proportion to the other resistances in circuit. The principle is derived from Messrs. Thomson and Varley's well-known slide resistance box. Eleven coils, with contact pieces, are arranged in series in the base beneath the turntable, this latter carrying two contacts, which serve to embrace two of these coils; a wire having double

PORTABLE ELECTRIC TESTING APPARATUS.

the resistance of a single coil is stretched round the edge of the table and joins the two contacts, being for final adjustment capable of subdivision at any point by the index arm which carries the battery current. When used for taking resistances, the connections are made to the two terminals marked X and B. The table is then set with the arrow pointing to such a number as on trial gives the smallest deflection of the needle, a final adjustment being obtained by moving the index arm. The number pointed to by the arrow is then read off as hundreds, that indicated on the table itself as tens and units. The instrument, as we ourselves have observed, gives fairly correct readings from 0·005 to 2,000 ohms, but will give approximate readings of a much higher value.

Two terminals (shown close together in the perspective view and diagram) are also provided for the insertion of extra battery power should it be desired to take insulation tests with a higher E. M. E. It would also be possible to measure the sectional resistance of cells by Mance's method, by taking out the ordinary cells, bridging over the two battery terminals, connecting the cell to be measured at X and B, and adjusting the galvanometer either by the torsion head or by an external magnet.

Lastly, the instrument can be used as a simple detecter by joining up to B and C, and using the left hand key.—*Electrical Review.*

Curious Case of Cause and Effect.

During a storm at Greenville, R. I., May 9, the lightning ran by the telephone wire to the Windsor Mill, where there is no telephone, but the wire is disconnected just outside the building. The lightning was led by the wire to the corner of the mule and weaving rooms, and entered the building under the jet. It followed the water pipe and set the sprinklers going, and at the same time fired the stock in the mules. By this singular provision of an active extinguishing agent at the moment the fire started, serious loss was prevented, as the fire was soon drowned out. Many of the spindles in the mules lost their temper, and some of the belts were burned, but the mill was saved.

Eggs by Weight, Count, and Measure.

There is a great deal of difference in the size of eggs, and therefore a difference in the nutritive value per dozen when used for domestic purposes.

From time to time the newspapers take the subject up, and argue the propriety of selling eggs by weight, instead of by the dozen, as is the custom in the Eastern and Middle States. But in California, we believe, not only eggs, but fruit and many kinds of vegetables, that are sold in New York and other Eastern cities by the dozen and measure, are sold in San Francisco by weight only, and we cannot help but think that the latter is the most equitable mode of dealing to both the seller and purchaser.

In the great market, the "Halles Centrales," Paris, France, the egg dealers do things still differently. The eggs are assorted, according to their size, by passing them through rings, which, like all other measures, have to be stamped. These rings have a diameter of 38 and 40 millimeters, and eggs which do not go through the larger ring are first quality; those which go through the first but not through the second are second, and all others which go through the second are third quality.

The Aasgeier and the Telephone.

According to the *Brazilian Germania* of Rio de Janeiro, the telephone wires in that city have found a formidable enemy in the "aasgeier," a large bird of the vulture species—a kind of John Crow—which flying very low, as it passes over the tops of the houses in scavengering the streets, hits the wires and breaks them or else becomes entangled. Good wire is very expensive in Brazil. In consequence of the damage done by these birds, the telephone people are compelled to keep up a large force of men for repairs. No sooner are the wires mended in one part of the city than report comes of interruption in another part, owing to the operations of the aasgeier. It is against the law to kill these birds, and as a result they increase very rapidly in number.

The *Provinzia,* too, says that nothing positively remedial can be done at present. The telephonists must wait until the bird learns by experience that it will enjoy more personal comfort by flying higher. It would be interesting to know whether anything similar to this has been noticed in other tropical or subtropical towns in which telephone wires have been strung. The advocates of underground systems may feel disposed to look on these John Crows as very sensible birds, engaged in making a laudable protest against aerial electric wires.

NATURAL HISTORY NOTES.

American Palms.—It is only when the literature of the order is brought together, says a writer in *Science*, that we appreciate the extent and varieties of palms. In the new Genera Plantarum of Bentham and Hooker there are 132 genera of true palms characterized, and about 1,100 species indicated. The following palms are indigenous to this country: Without counting one or two tropical species, which grow in Southern Florida, and which are outlying Cuban and Bahaman species, we have two true palmettoes—*Sabal palmetto* and *S. Adansoni*; the Blue palmetto, *Rhapidophyllum hystrix*; the Saw palmetto, *Serenoa serrulata*; just beyond our national borders, on the islands off Lower California, a palm of a peculiar genus called *Erythea edulis*; and finally, in Southern California, the elegant *Washingtonia bilifera*, named in honor of our first President.

Scales, Feathers, and Hairs.—The idea current among naturalists generally, and largely taught to students, that scales, feathers, and hairs are identical in nature, is combated by Mr. J. E. Jeffries in a recent issue of the *Proceedings* of the Boston Society of Natural History. Mr. Jeffries considers the epiderm to be the primitive, if not the true skin, as it is formed long before the corium, which is a late and very variable product of the mesoblast; and because all the organs of sense are formed from it. The epiderm may be considered as primitively consisting of a smooth mucous layer, an epitrichial one, and perhaps an intermediate one of parenchymatous cells. In birds and mammals the outer layer is lost, and never renewed, while the middle layer becomes thickened and subject to various modifications, such as drying, conversion into horn, etc. Scales are moulted and renewed, scuta are not. The toe pads of birds may be seen to pass over into scuta on the sides of the toes of many birds. Scuta bear feathers as epidermal appendages, scales never do, thus pointing to scuta, which have a mucous layer and outer horn coat, with a mesodermal core, as simple folds of the skin, not as appendages.

The early stages of a feather and of a hair differ. The latter is formed in a solid ingrowth of the epiderm, and the latter from the epiderm of a large papilla. A hair does not contain any of the mucous cells, while a considerable portion of a feather consists of them. The supposed homology between feathers and scales seems to fail before the facts that the mucous layer is absent in the latter, and that Studer has shown that the imagined scale-like nature of the remiges of the penguins is a fallacy.

Mr. Jeffries avows his belief in the distinct origin of the dermal appendages of the higher vertebrates, and asserts that the nakedness of the Amphibia is a strong argument against the identity of any of the alvian appendages with those of reptiles or mammals.—(*American Naturalist.*)

The Coloring Matter of Flowers.—The petals of flowers are far oftener colored by a pigment soluble in the cell sap than by one in a solid, granular form. Of 200 species examined by Mr. P. Fritsch, who has recently investigated the subject, only 30 contained solid pigments in the cells either of the petals or of the fruits.

Far the most common of these solid pigments is yellow, much the greater number of yellow flowers, including nearly all the yellow compositæ, being indebted for their color to substances of this nature.

Exceptional instances of soluble yellow pigments occur in the petals of *Dahlia*, *Althæa* (marshmallow), and *Tagetes* (marigold), and in the hairs of many species. Solid yellow pigments are described in *Impatiens longicornu*, where they vary greatly in size and form, in the Indian cress (*Tropæolum*), in the evening primrose, pot marigold (*Calendula*), pansy, cone flower (*Rudbeckia*), digitalis, etc. The particles of pigment are often seen in a state of active molecular motion; they are always colored green by iodine, and are soluble in concentrated sulphuric acid, with a deep blue color.

The pigment appears to be always embedded in a matrix of protoplasm. A solid red pigment was observed in the fruits of the dog rose, mountain ash, lily-of-the-valley, white bryony, spindle tree, climbing bittersweet (*Celastrus*), and yew. The red pigment in the cortical portion of the root of the carrot is of a very peculiar kind, resembling long, pointed crystals.

Insoluble violet pigments are rare, but occur in *Thunbergia alata* and the larkspur; while blue granules are found in the fruit of *Viburnum tinus*. Brown insoluble pigments were found only in the seaweeds *Fucus* and *Furcellaria*.

The development of the colored granules does not end with their acting as pigments; for after this period they go through a variety of changes of development or degradation.

Points about Patents.

The belief of some persons that sugar in paying quantities can be got from corn stalks as well as from sorghum, recalls the fact that the State of Connecticut gave to Edward Hinman a patent for making molasses from corn stalks in October, 1717, or nearly 167 years ago. Senator Platt, who introduced this statement in a recent speech, cited some other curious old Connecticut patents, showing that the spirit of invention was rife there at an early date. There were no devices in the list for manufacturing wooden nutmegs, but in 1783 a patent was given to Benjamin Hanks for "a clock which will wind itself up."

Another interesting point that may be derived from Mr. Platt's tables is that, while in 1790 there were but three patents issued by the United States Government, in 1792 but eleven, and in 1795 but twelve, the issue for year before last was 18,135, and for last year it was 21,196. At certain epochs there have been remarkable jumps in the annual list. Thus, in 1854, the number of new patents rose to 1,759, from only 846 for the previous year, and the gain was held and continued. So, in 1866, the new issues were 8,874, but the following year the number bounded to 12,301. Very oddly, it never afterward varied two thousand, up or down, during fourteen years, the new issues for 1880 being 12,926. But the next year the number suddenly started forward to 15,548, and there have since been steady and great gains. If the reissues and the designs of last year should be added to the new patents, the aggregate would be 22,383.

THE TIGER BY INSTANTANEOUS PHOTOGRAPHY.

The portrait of the tiger which we herewith reproduce from *La Nature* was obtained by the same process as the one of the lion that we gave last year, that is to say, an instantaneous photograph was reproduced directly upon wood, and then accurately engraved by the artist. The photograph was taken by a skillful English operator, Mr. Henry Dixon.

THE TIGER BY INSTANTANEOUS PHOTOGRAPHY.

Compressed Air Delivered in Pipes.

The machinery and plant of the Birmingham Compressed Air Power Company, which is shortly to be laid down upon a site already selected, will cost, with the necessary buildings and service construction, some £140,500. It will be capable of delivering 5,000 indicated horse power in compressed air. At the outset there will be put down four air compressing engines driven by compound condensing steam engines, and heated by six sets of elephant boilers, four in each set. Now, in the three wards forming the experimental area, we find from the latest total returns that scarcely 3,000 indicated horse power can be needed for engines up to 30 horse power; it may fairly be assumed that for no engines above that power is the new motor likely to supplant steam, since the pressure obtained by the user even after reheating will not exceed 40 pounds to the square inch. The whole of the surplus 2,000 indicated horse power is scarcely likely to be used up by tradesmen other than those engaged upon industrial processes, by builders and contractors for working winches and cranes, and by tramcar companies. In any case the user will have to look to the ice difficulty by having the service pipe passed through the nearest flue, or making special arrangements.

The air will be supplied at a pressure of four atmospheres, and heating to at least 321° Fah. will be necessary to obtain the best results. However, should the estimates of the engineers be anything like correct, the scheme should be a success. They see their way, it is said, to furnish the compressed air at forty dollars per annum per indicated horse power. An addition of 20 per cent—assuming say $50 for small steam power—is suggested. This movement, contemporaneously with the starting of refrigerating plant in the same town, is of much industrial significance for Birmingham, and of interest to all engineering centers.

Dr. Adolph von Bruening.

The German color industry has met with a serious loss by the death of Dr. Adolph von Bruening, who died suddenly in his forty-seventh year of age, on the morning of April 21 last, at Frankfort-on-the-Main. He was one of the founders of the colossal color works, known to the industry as the "Farbwerke, formerly Meister, Lucius & Bruening," at Hoechst-on-the-Main, which owe their flourishing condition in a great measure to his proficiency and inventiveness as a practical chemist. The excellent organization of institutions for the laborers connected with the color works are the manifestations of his philanthropic care for his subordinates. He was born at Ronsdorf, near Elberfeld, in 1837, and only a year ago he was raised to nobility, by the Emperor Wilhelm, in acknowledgment of his patriotism and distinguished merits in industry. He was also a member of the German Reichstag, representing from 1874 to 1881 the district of Homburg-Usirgan.

Whitewood.

Whitewood is gaining favor rapidly. Not many years ago it was used in this vicinity chiefly for coffins and wagon box boards. Farther south, in the sections where the wood grows, it has been used for finishing to considerable extent, but builders who could readily get white pine discarded whitewood.

Until recently, for finishing purposes, and for the manufacture of sash, doors, and blinds, whitewood was little thought of north of those sections where it grows plentifully. A representative of one of the largest sash, door, and blind factories in the country recently said in this office that if he were building he would have little choice between pine and whitewood for the purposes above mentioned. He admitted that his interest is purely identified with white pine, and that he would not admit openly that whitewood is the peer of pine; such, however, in his opinion, is a fact. This is a big admission to come from such a source, but one that is based on a good foundation.

It can be easily understood why whitewood can be used successfully for many purposes for which pine is employed. It is more inclined to twist than pine, but this is not much of an objection where it can be used in small pieces, or if in large ones, securely fastened. Even gum, the most rebellious wood that grows out of the ground, if properly nailed, answers for finishing admirably. Whitewood is very easy to work—it probably ranks next to pine in this respect—takes a good finish, and makes a close joint. There are complaints against cypress for sash, doors, and blinds because, it is said, it is too hard a wood to drive together and make a perfect joint. Too much work must be put on the pieces where they come in contact to cause them to fit closely. In pine work this extra work is unnecessary. The wood is so soft that it readily gives, and the tight joint is at once produced. There are others who claim that such a fault with cypress does not exist; but that it does somewhat there can be no question. Not that perfect cypress sash, doors, and blinds are not made, but it requires a little more attention and labor to make them than it does from pine. In regard to softness, whitewood probably ranks next to pine; it is not quite so easily worked as pine, and a little more easily than cypress.

The easiness with which whitewood can be smoothed is greatly in its favor, as it is prepared at light cost for the paint. Its ability to hold paint well is questioned, and justly where the lumber is used on the outside of a building. Place two boards, one pine and the other whitewood, side by side in an exposed condition, and paint them at the same time and with the same number of coats, and the pine without question would look the better for the longer time. For inside work, though, any difference that may exist in this regard would not count for enough to take into consideration. The paint holding quality of whitewood is good, while in white pine it is extra good.

The cost of whitewood is decidedly in its favor. When clear whitewood can be bought for $20 per thousand less than clear pine, the difference shows up in the light of a big inducement to the consumers of lumber. With many there would have to be big advantages in favor of pine to counterbalance this difference in price. Twenty dollars in a thousand feet of lumber is a good deal of money, and when such a difference exists there ought to be more points in favor of the higher priced lumber than in this case really exist. As the prices of the different kinds of lumber are now ranging, whitewood, considering its value, is the cheapest finishing lumber to be had.

With the popularity that whitewood is winning it is not to be wondered at that whitewood stumpage is increasing in value, and it may be expected to be worth still more. Not many years ago it did not take much money to buy as much timber as any man cared to own, and few cared to own much; but now it is sought not only where it can be immediately got at, but in the out-of-way places which will necessitate the timber standing until improvements in streams and in the way of building railroads are made. It has also come to light that it is not so plentiful as many, a few years ago, supposed it to be. In some of the best Tennessee districts a good share of the available whitewood has been cut; a big proportion of it, when it is considered how short a time the whitewood mills have been at work.—*N. W. Lumberman.*

New Style of Parlor Car.

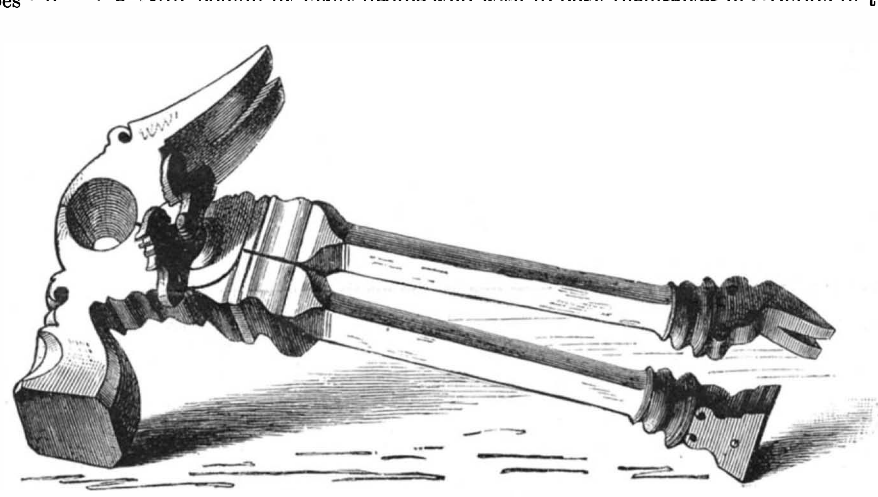
The Pennsylvania Railroad Company have had built at their Altoona shops a parlor car, No. 901. Its dimensions are 62 ft. in length, 9 ft. 10 in. in width, and 9 ft. from the floor to the upper deck of the roof. It is constructed upon an entirely new plan. It contains five separate compartments, retiring rooms for ladies and gentlemen, one at each end of the car, the main parlor, a ladies' boudoir, and a smoking room. The parlor contains four movable rattan chairs, fourteen fixed chairs, and a sofa, a seating capacity of twenty-one. A noticeable improvement is the manner in which the fixed chairs are secured. They are balanced on a handsome brasswork pivot, and furnished with two gracefully curved brass legs at the back, which upon the occupant reclining and the chair touching the floor and giving the chair stability, prevents unpleasant swinging from one direction to another when turning sharp curves, and at the same time readily permits the chair to be moved while in that position, as the feet of the legs are formed of easily moving rollers.

The boudoir is 7 ft. by 6 ft., and contains a lounge and three rattan chairs. A wooden partition of the height of the window sills separates it from the parlor, and entrance to it is obtained through a highly ornamented gate. Rich curtains, of fine plush, of a *gendarme* blue, supported by rods attached to a framework of oak, afford the means of securing to the occupants perfect privacy if desired.

The smoking room is 12½ feet by 6 feet. Partitions reaching to the roof divide it from the other portions of the car. A novel arrangement of the windows has been adopted. Instead of the old style flat window, there are five bay windows on each side, each window about 7 ft. in width. The center light or outer glass of each window is within the outer line of the car, and from it two panes deflect inwardly in opposite directions. This arrangement affords not only a greater lighting surface, but enlarges the prospect from the window, and, it is claimed, ventilation and air can be secured without the introduction of cinders by opening the rear panes of these windows, thus forming a draught outward from the interior. The interior woodwork is oak, prepared to resemble English oak. There is no frescoing or veneering, but the ornamentation consists of elaborate carving and beautiful repousse brass work, exquisite chandeliers of brass, cut globes, rich upholstery and carpets, delicately stained glass ventilators, all harmonizing delightfully and giving a most pleasing air of solidity and comfort. The exterior is painted in the standard red of the company; the guards and railings of the platforms are nickel plated, and the body of the car rests upon two six wheel trucks, larger than ordinary, the introduction of an additional spring giving greater ease.

AN OLD UNIVERSAL TOOL.

Several years ago a so-called "universal tool" was advertised everywhere as an American invention, and this tool is still bought by many people who wish to busy themselves in a practical way, but have not had sufficient experience to know that such an implement is not convenient. It is interesting to know that this "novelty" is very old, and had died out of existence until the modern imitation of old things brought it to light again.



AN OLD UNIVERSAL TOOL.

In the collection at the Flechtingen Castle, among other things, is the "universal tool" shown in the accompanying cut, taken from the *Illustrirte Zeitung.* This implement is at least three hundred years old; it is almost nine inches long, very heavy, of very good workmanship, and bears traces of having been gilded.

Electricity and Light.*

Electricity appears almost to realize for us one of the oldest and most striking of the representations of creative power, "Let there be light, and there was light." In most of our other sources of artificial light we appear to consume something which to the ordinary mind is converted into light. Here we have to all appearance light produced out of nothing, or as the next step from the ordinary unscientific reasoning to that of partial scientific enlightment, *electricity converted into light.* A further advance in knowledge teaches us that—1. Electricity is not converted into light; 2, that no illuminating agent is so converted; 3, that light does not exist at all; that it is not *a thing*, but the *perception of an action.* The light is in the eye itself.

2. *Light is a function of energy,* and its study involves four considerations—1. The phenomena of its origin; 2, the mode of its transmission across space; 3, the nature of its perception; 4, the energy expended in these several processes. Each of these calls for and will be worth some little examination; but inasmuch as one of the great dangers of science is the acceptance of *words* (which are worthless except in so far as they convey a definite meaning) in the place of realities, it will be well to begin at an even earlier starting point. Electricity itself is a word which we all use, and which too many employ as though it were one of the old "words of power," the mere utterance of which is in itself sufficient to place the powers of nature under subjection. Yet what conflicting ideas exist as to what the word really means, and how few could give a really intelligible explanation of what they mean by it. That task we need not now attempt; but the latest of these magic names of science which we shall have much occasion to use calls for some particular consideration.

3. *What is energy?* We have outgrown the intellectual stages at which men invented a specific fluid to answer such a question, and we recognize that we cannot say what anything *is;* we can only state the idea we form of it from its actions; we have no conception of energy except as a relation of matter and motion. It may be either expressed as the work capacity of matter in motion, or of matter under a stress capable of generating motion. But the essential feature of the modern scientific ideas as to energy is the recognition that it is uncreatable and indestructible. We can form no concrete idea of its nature; it is best conceived as *motion,* yet it is impossible to even conceive of motion apart from matter. It must therefore be recognized as an attribute of matter, yet distinct in its origin and nature, because it is transferable from one mass of matter to another, and even to that more intangible something, the *ether.* It is here, in fact, that the most usual explanations of energy fail us; we can form some sort of idea of energy in the form of work imparted to or effected by a moving mass of matter, but the imagination fails in realizing the existence of vast stores of energy in mere space. It is a relief to accept the "ether," of which we know nothing, as almost representing the underlying essence of all things—the *substance* of metaphysics, endowed by the mathematician with the properties of an elastic solid, possessing none of the attributes of *matter* itself, while it is interchangeable with matter in the relations of energy.

4. *Kinetic energy* appreciable as work is the natural starting point of the endeavor to reach the unseen. A cricket ball struck by the bat gives us a perfect picture of the nature of energy, for it shows us an inert mass of matter suddenly endowed with motion, and with the capacity of doing work in consequence of that motion. We know that this capacity of doing work has been imparted to it from the muscles which moved the bat, that it is partly expended in friction of the air during its transit, and that if the motion is suddenly arrested some considerable results may be produced; in fact, the ball has received, has transmitted, and has transferred that something which modern science calls "energy," and which is one most important element out of which modern science is constructed.

5. *This energy can be definitely measured.* But here we should clearly recognize that, while professing to measure a thing which has after all no conceivable existence, we are measuring, not the thing itself, but an effect it produces. This not an idle truism, for probably few people realize that it applies to all measurement, to all our knowledge. The most concrete idea—apparently—is that of matter, and the most apparent of our conceptions of matter is its *weight,* or in scientific terms, its mass. Yet, when we weigh a thing we are *not weighing matter itself,* we are merely measuring a *force exerted by it.* In ordinary cases we simply measure the mutual forces of attraction of the earth and the object.

6. *The most concrete measure of energy* is furnished by this very attraction, viz., the unit of mechanical work, the foot-pound, the energy imparted to a pound weight while moving through one foot of space under the force of the earth's attraction, or which must be expended in lifting that pound weight against the earth's attraction.

7. *Heat gives us another concrete unit* in the quantity of heat, which is now known to be an action of energy, necessary to raise one pound of water one degree of temperature. Here again, however, we have to recognize that we cannot measure a thing itself, but only its effects. We speak of a *quantity of heat,* but we never measure *heat itself;* we measure either a temperature effect, variable in every separate substance, and necessary to be ascertained by experiment, or we measure an expansion effect variable also in every substance except in pure gases.

8. *The correlation of the forces,* the knowledge of which is the greatest achievement of this age, as far as pure science is concerned, because it is the starting point of progress of discovery in all directions, means that many actions which used to be attributed to special fluids or *forces* are merely different manifestations of *energy.* It follows, therefore, that one unit of energy can represent all these actions; that is to say, that just as a quantity of heat contained in a mass of red hot iron can be expressed in terms of the number of pounds of water it will raise 1° F. in temperature when the relations are ascertained, so can it equally be expressed in foot-pounds of mechanical work once the interrelation of these actions of energy is ascertained.

9. *The action of heat on a pure gas* is the most apparent evidence of this relation, although not the one by which it is usually illustrated. We can impart heat to a gas in two ways: 1. The gas being inclosed in a rigid vessel and heated, a certain number of degrees exhibits that heat in the form of temperature, just as water or iron does; this is the *heat of constant volume.* Under these circumstances a force is also developed—a pressure or tendency to expand. 2. The gas may be allowed to expand freely while heating, and will now absorb what is called the *heat of constant pressure.* Now, if we pass the gas into a calorimeter, we shall find that the heat of this second case is the greater by a

* John T. Sprague in the *Electrician* (London).

measurable quantity. But as the same quantity of gas is at the same temperature in each case, how has this excess of heat been disposed of so as not to be apparent, and yet capable of being recovered? Something else has been done besides heating the gas; the art of expansion involved the lifting a column of the atmosphere, and this work can be measured in foot-pounds. This work therefore represents the energy corresponding to the difference of the two heats. Various experimental conversions have been made resulting in the two figures of 772 foot-pounds and 1 pound 1° F. of water, which are received as the "mechanical equivalent of heat;" that is to say, the same quantity of energy will appear as either of the two forms, and one pound of water falling 772 feet would be heated 1° if it could be stopped so as to retain in itself the whole energy of the earth's attraction.

10. *Potential energy* is more difficult to conceive than kinetic, but our cricket ball may furnish some ideas. When it is flying through space it is not doing work, except as friction in the air; but it has the capacity to do work, and this friction work is a gradual exertion of that capacity. Its motion at each instant is therefore the measure of its remaining capacity, and is in fact the consequence of and the evidence of the energy *potential*, or latent in the ball. Now the unscientific mind would imagine that this energy was created by the striker, the production of his will; but science knows that the player no more created the energy than the bat did. The player in exerting his muscles burnt away a portion of their material or consumed some of the substance stored in his blood and derived from his food; in fact, he corresponds in function to a steam engine and boiler fed with coal. We come then to the result that he simply transferred *potential* energy to the ball, converting it first into *kinetic* energy or mechanical work in his muscles. The food itself simply stored up energy derived from the sun's beams, because the process of vegetable life is a continual *unburning* of hydrogen in water and carbon in carbonic acid, and the setting free of oxygen in the air, a process which requires an equivalent of energy to be imparted to the atoms, which energy they give up on their reunion, whether in the lungs and muscles of the cricket player or the boiler of the steam engine.

Boiler Settings and their Defects.

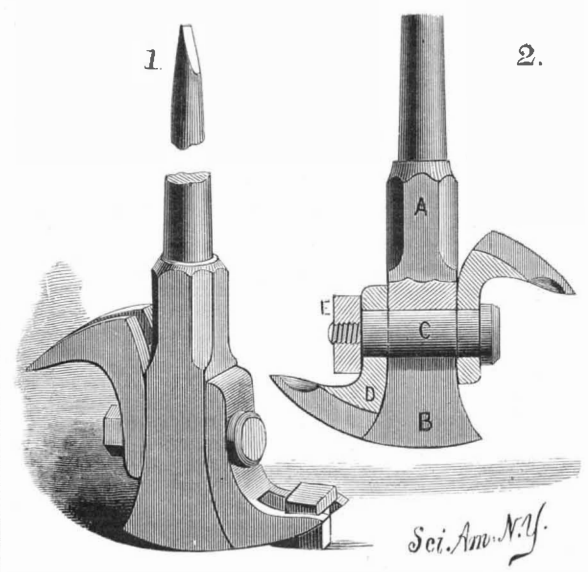
The *Locomotive* is a small sheet published monthly by the Hartford Steam Boiler Protection and Insurance Company; every issue contains a list of the boiler explosions and such other casualties, pertaining to steam appliances, which have occurred during the month prior to the issue of the paper.

The officers and engineers connected with the above company, from their experience derived in the inspection of boilers and their business as underwriters in this kind of risks, have more than ordinary opportunity for knowing which class of boilers are the best for the work required of them, as well of the best mode of setting them and the best attachments for insuring economy and safety. The May number has an article condemning the running of flues over the tops of boiler shells, as follows:

"One would naturally suppose that when the number of boilers that have been ruined, and the still greater number that have been seriously injured, by this form of setting is taken into account, no one would think of setting new boilers in this manner. Yet it is done every day, and by intelligent and experienced men too. The argument used in its favor, that the passage of the hot gases over the steam space superheats the steam, and thereby renders it more economical, is a plausible one, and doubtless leads many steam users to adopt this form of setting; but if the circumstances are carefully examined, the argument will be seen to be fallacious. It will be impossible to superheat steam when it is in intimate contact with such a large surface and body of water as it is in the case of a tubular boiler. Moreover, it will be difficult for any one who has in mind the poor conductivity of ashes to see (when looking into one of these flues after it has been running a few months) how superheating of the steam can occur. Our experience with this form of setting (and it is a somewhat extensive one) points to this: So long as the brickwork at the sides of the boiler is perfectly intact, so as to *compel* all the gases of combustion to pass through the tubes before they reach the top of the boiler, and the water is good, the influence of the flue is *nil*, because, if the boiler is properly proportioned, the temperature in the flue cannot much exceed that of the steam in the boiler, and if the boiler is badly proportioned, the deposit of ashes which soon collects on top of the shell protects it, in a great measure, and this very protection is sufficient to prevent any superheating of the steam. But as soon as the side walls begin to heave, as they almost always do, and crowd away from the boiler shell, *then* the fire takes a short cut up past the side of the boiler into the flue, the draught is sufficient to carry away the ashes at the points where the openings are, and the exposed portion of the shell gets "scorched." Sometimes, when the feed water is very acid, the overheating, while hardly violent enough to burn the plates, is just sufficient to bake all scum on the surface of the water on to the shell above the water line, beneath which coating corrosion goes on with surprising rapidity. We have seen boilers set in this way, with a coating several inches thick above the water line, after they had run only a year, beneath which the plates were eaten nearly half way through, while other boilers in the same room had been running under the same circumstances, with the single exception that the flue did *not* pass back over the shell, for upward of fifteen years, and only showed very slight traces of this action. This seems to us to be conclusive evidence of the injurious action of this form of setting, aside from the liability, at any time, of the side walls becoming so badly disarranged that actual overheating and fracture therefrom may occur.

IMPROVED CLAW BAR.

An invention patented by Mr. Hugh Robertson, of Breckenridge, Minn., relates to claw bars for drawing spikes from railroad ties and for similar uses. Fig. 1 is a perspective and Fig. 2 is a sectional view. The bar is chisel shaped on the extremity of the handle, and upon the opposite end is formed a convex head having concave sides. The end of the bar is slotted to receive a bolt that clamps the auxiliary claws to the sides of the bars, the inner faces of the claws being curved to adapt them to the concave sides of the head. The points of the claws extend outward



ROBERTSON'S IMPROVED CLAW BAR.

from the sides of the bar nearly at a right angle, and are slotted to receive the body of the spike to be drawn. The claws, near their points, are countersunk to receive the head of the spike, and the sides of the bar are similarly countersunk. The claws may be both clamped in position for use, when the head of the bar and the outer surface of the claws will form a curve of long radius. The bar may be used without the claws, or one of the claws may be attached in position for use and the other reversed. The bolt is flattened and fitted to the slot in the bar and to oblong holes in the shanks of the claws, which are thus prevented from turning. The chisel at the end of the handle can be used to form a cavity into which the claw may be inserted if there should be any difficulty in getting under the head of the spike.

WATER COOLER.

An invention recently patented by Mr. J. E. Welling, P. O. Box 100, Georgetown, Ky., is shown in the accompanying cut. The space between the removable water tank and the shell is filled in with some good non-conductor of heat. The faucet passes through apertures in the tank and shell, and is provided with annular shoulders which are kept pressed

WELLING'S WATER COOLER.

against the outer surfaces by a nut screwed upon the inner end of the faucet. On the back of the outer shoulder are two lugs which enter notches in the edge of the aperture in the shell, and thus prevent the faucet from turning.

The shell is provided with a removable bottom having a folding handle upon the under side. On the edge of the bottom is a series of notches, and the base of the shell has a corresponding number of lugs. To secure the bottom in position it is so placed that the lugs pass into the notches when it is turned so that its rim, between the notches, rests over the lugs. After the tank has been secured in the shell, the whole is inverted, the space is filled with sawdust, mineral wool, or other non-conductor, and the bottom fastened in place.

Antimony in Dyed Cotton Yarns.

BY DR. CARL BISCHOFF.

As is well known, it is at present a frequent practice to fix aniline colors on cotton yarns intended for stockings, etc., by means of tartar emetic and tannic acid. Commonly the yarn is first drawn through a sumac bath and then run into water containing the dye, together with the necessary quantity of tartar emetic in solution. In this way a tannate of antimony is formed, which is found to adhere well to the fiber, and acts as a fixing agent for the color, consequently the majority of dyed stocking yarns of all classes above the lowest contain appreciable quantities of antimony. Soluble antimony compounds, especially tartar emetic, when applied to the human skin in suitable and sufficient doses, cause a peculiar cutaneous irritation and inflammation.

Now, although the above mentioned method of fixing anilines may almost be called fast, owing to the colored antimony compound being difficultly soluble or pretty insoluble to water, yet under certain circumstances, among which may be mentioned insufficient rinsing, by no means unimportant quantities of soluble antimony compounds, more especially of tartar emetic itself, may remain in the finished yarns. In the last few months of 1883 a large firm of cotton stocking yarn dyers was induced to institute a research on a considerable collection of samples dyed in baths containing tartar emetic. Complaints of injury to health, etc., resulting from wearing miscellaneous goods which had been manufactured from these yarns, were the cause of this step being taken. The intention was to have determinations made of the quantities of antimony which might remain in such yarns after skilled dyeing and proper rinsing, also of the extent to which the aniline antimony tannate lakes remain soluble in water, and finally to ascertain how much antimony could be got out of the aforementioned lakes on the application of energetic dissolving agents.

The samples examined were fair average ones, not specially treated nor specially selected. After extraction of weighed quantities of yarn by means of hot water, the antimony was determined both in the aqueous extracts and in the yarns remaining therefrom. Digestion with concentrated muriatic acid, sometimes after addition of chloric acid, was the means employed for solution of the antimony firmly held in the yarns. Sulphide of ammonium was the precipitant employed, and when weighable quantities were obtained the precipitate was converted into and weighed as antimony pentoxide. The following scheme clearly and concisely exhibits the results obtained:

ANTIMONY IN DYED COTTON YARNS.

(Traces not determinable quantitatively.)

Color of Sample.	Soluble in Water. Per cent Antimony.	Soluble in Acid. Per cent Antimony.
1. Bluish violet	traces	0·11
2. Red (Bordeaux)	traces	0·26
3. Dark violet	0·012	0·12
4. Light reddish brown	traces	0·24
5. Pure blue	traces	0·13
6. Dark blue	0 008	0·25
7. Light red (Bordeaux)	traces	0·18
8. Bluish violet	traces	0·10
9. Scarlet	0·008	0·22
10. Dark red brown	traces	0·244
11. Dark red	traces	0·31
12. Red brown	0·0135	0·30
13 Scarlet	0·014	0·20
14. Light blue	traces	0·036
15. Water blue	traces	0·11
16. Orange brown	traces	0·121
17. Brownish violet	traces	0·20

It is well to be borne in mind that the weight of a pair of ordinary cotton stockings is about from sixty to seventy grammes. Hence the antimony contents of such articles made from these yarns would be with a maximum say 0·25 gramme. Only the quantity of antimony which is soluble in water can in this case be of physiological importance, and, according to the above table, this amounts to a maximum of 1 5 centigrammes per pair of stockings. We leave it to medical experts to figure out the influence on the health of the individual exercised by these quantities of antimony. We, however, do not by any means deny the *possibility* of cutaneous irritation, etc., in cases where the dyeing has been done in a loose, slovenly manner, no care given to the indispensable rinsing, and consequently the percentage of antimony soluble in water rendered comparatively high.—*Tex. Manuf.*

New Telegraph Cables between Europe and America.

A new cable is now being laid between Iceland and Nova Scotia, thence to this country, by Messrs. Bennett and Mackey. The cable used in the present enterprise is undoubtedly the best that has ever been made, representing the accumulated experience gained in the construction of all previous ocean cables. It was manufactured by the Messrs. Siemens at their works near London. Upward of 2,500 men are employed in the establishment, and 1,700 of these were employed on the present cables, for there are two of them, two to extend side by side from Ireland to Nova Scotia, whence one goes to Rockport Mass, and the other round Cape Cod to Fire Island, N.Y., and thence to New York. The aggregate length of the two is over six thousand miles. The shore ends are two and one-half inches in diameter, while the cable proper is but one inch in diameter. The conductor is formed of thirteen wires, consisting of twelve small wires coiled around a central wire one-tenth of an inch in diameter. The insulating material is gutta-percha, between which and the armor there is a cushion of jute.

ENGINEERING INVENTIONS.

A dumping car has been patented by Mr. Terrence Reynolds, of Atalla, Ala. This invention covers a tilting platform journaled at points a little in front of its center to a stationary frame, worked by various special arrangements and devices, to facilitate the unloading of cars in mines and other places where loads are to be dumped.

An amalgamator has been patented by Mr. Edward Pike, of Salt Lake City, Utah. The invention provides for a sluice box with opposite riffles, faced with amalgamated plates, and connected with wires leading to a generator of electricity, in order to save fine gold, floured quicksilver, and amalgam, and facilitate the concentration of ores and gold and silver tailings.

An ore concentrator has been patented by Mr. John L. Loomis, of Leadville, Col. Inclined sluices are made to abruptly change the course of the current at numerous intervals, combined with which are water pipes having jet orifices or tubes to increase the volume of water in the sluices and disturb the pulp in the current, thus facilitating the separation of the ore from the lighter accompanying particles.

A car coupling has been patented by Mr. William M. Robinson, of New Franklin, Mo. In combination with a drawhead is a side pivoted lever, with a laterally moving coupling pin held in the front end of the lever, the inner end of the lever being connected with a sliding vertical bar in the drawhead, this vertical bar being connected with a pivoted lever for moving the bar to the front to uncouple the drawheads.

A car coupling has been patented by Mr. John Mealey, of Prescott, Ontario, Canada. Each drawhead has one hook and one socket, the hooks being always in the same side, so the couplings will match when two cars run together; the device may also be made to work with the ordinary link and pin coupling, when cars of other systems are used, and there are various special novel features for making an automatic coupling.

A car brake and starter has been patented by Mr. Frank Tompkins, of New York city. Combined with the front axle of the car is a ribbed wheel on the axle, with sliding sleeves, the latter having ribbed disks to engage with the ribbed wheel, chains on these sleeves being connected with an air compressing piston in a cylinder, a rack connected with the piston engaging with a ratchet wheel on the rear axle for revolving it when the piston is forced outward by the compressed air, thus using the energy stored in braking to help start the car.

A process of and apparatus for producing heating gas has been patented by Mr. Herman Haug, of Dortmund, Prussia, Germany. The essential principle of the invention is that the quantity and intensity of heat necessary are produced principally by superheating to a high degree the converting agent, which may be steam or carbonic acid, or mixtures of them with air or with combustible gas, while the crude carbonaceous material contained in a converting chamber may at the same time be heated through the walls of this chamber.

MECHANICAL INVENTIONS.

A pipe wrench has been patented by Mr. Conrad D. Volkmann and William F. Peddycord, of Napanee, Ind. This invention relates to that class of wrenches in which a toothed body piece is opposed by a self-adjusting hook, and makes a wrench that is strong and reliable, suitable for use on large and small pipes, and adapted to take hold of short pipe nipples.

A grinding mill has been patented by Mr. Charles C. Burner, of Traveler's Repose, W. Va. This invention is for mills used for grinding apples to pomace preparatory to making cider, and provides for the cogs being slid out and in with mechanical certainty and ease, their mortises kept clear, and the apples being gradually reduced to the fineness required.

A polishing wheel has been patented by Mr. Daniel W. Abbott, of Leetonia, Ohio. It is proposed to make the wheels without central holes for the mandrels, so purchasers may readily fit them to the mandrels in use; the plan for securing the leather is simple and efficient, and the wheels may be cheaply made, either for roughing purposes or smoothing and polishing.

A rag engine for paper making has been patented by Mr. William Whitely, of Housatonic, Mass. This invention covers, in part, improvements on former letters patent issued to the same inventor, and the lighter supporting posts are made in two parts, connected by bolts, so the upper parts can be conveniently detached to give easy access to the ends of the lighters, and allow them to be easily removed, with various other devices to facilitate the leveling and adjusting of the rolls.

A saw set has been patented by Mr. George A. F. Clayton, of Masonville, Va. The invention consists of an inclined bed plate with an angular face, on which the teeth of the saw are to be bent, over which is a die for bending them, arranged on a pivot, and with a spring to raise and hold it for adjusting the saw; over the die, also, is a press screw with great pitch, with weighted lever handles, to work quickly and set the teeth accurately, the whole being readily attachable to a bench or other support.

MISCELLANEOUS INVENTIONS.

An automatic fan has been patented by Mr. Logan W. Everhart, of Parsons, Kansas. It is operated by clock mechanism or by a rubber spring, and may be suspended from a ceiling, to be easily raised or lowered to suit convenience.

A meat clamp has been patented by Mr. Joseph H. Tabony, of New Orleans, La. It is a device adapted to be attached to a butcher's bench, or to a small bench to be set on a table, to hold hams or other meat, and thus promote convenience in slicing.

A composition of matter for giving a metallic surface to paper has been patented by Mr. Julius Fransecky, of East New York, N. Y. It consists of argentine, vermilion, silver bronze, etc., in certain definite proportions, applied in a specified manner, whereby a coating and metallic luster are given.

A lock for wagon end gates has been patented by Mr. Andrew Sproul, of Hannibal, Mo. A rod is held to turn on the outer surface of the end gate, the ends of the rod being bent over the ends of the gate, and adapted to engage with studs projecting from the side boards of the box.

A vehicle spring has been patented by Mr. Willard S. Everett, of Hyde Park, Mass. This invention covers a new form of spring, arranged in elliptical or circular form, with an ordinary or diamond shaped or semi-diamond shaped base, thus combining in one spring the action of the two forms of springs.

A flour refiner has been patented by Mr. Isaac Morgan, of St. Louis, Mo. Within a suitable casing are a rotary shaft, suction fan, agitators, conical feeder, and various special arrangements, for separating impurities as the flour is fed in and drawn through the machine.

A spring shade roller has been patented by Mr. Gideon B. Massey, of Mount Vernon, N. Y. It is so constructed that when the shade is suddenly released the roller will be checked, and will be prevented from winding up the shade too far, as is now commonly the case with ordinary spring rollers.

A hold back for pole irons of wagons has been patented by Mr. William D. Hatch, of Olean, N. Y. The invention covers a novel construction and combination whereby the pole iron is protected from wear and prevented from cutting into the pole by the pull of the neck yoke ring on the hold back.

A street car fare box has been patented by Mr. Gustave S. De Blanc, of New Orleans, La. Combined with a fare box having an orifice or chute for receiving the fare is a bell or gong so placed as to be struck by the money as it drops, thus giving an audible signal to the driver and passengers.

An improved gate has been patented by Messrs. Josiah Austin and Rossco Chamberlain, of East Liberty, Ohio. This invention covers improvements on automatic gates formerly patented by the same inventors, by which a quicker movement is obtained, and the gate is operated with greater facility.

A portable apparatus for heating mineral water in bottles or flasks has been patented by Mr. Edwin D. Newton, of New York city. The invention covers a special construction of apparatus whereby the necessary heat may be readily obtained from a lamp or gas burner, and regulated by a thermometer, so that any desired temperature may be maintained.

A device for thawing out sink spouts has been patented by Mr. John G. Coburn, of South Carthage, Me. In combination with a hot water pipe, end threaded on the outside, is a cup and internally threaded case, the cup screwing on the pipe and the case on the cup, to facilitate the pouring of hot water into sink pipes for thawing them out.

A multichambered bottle has been patented by Mr. Edwin D. Newton, of New York city. The bottle has one or more thermic chambers, each with an orifice at its lower end to introduce hot water or a heating fluid, with passages at the upper end for the escape of air, the thermic chambers being surrounded by fluid chambers for rapidly and uniformly heating the fluid.

A wagon tongue support has been patented by Mr. William P. Martin, of Chico, Cal. Brackets are so arranged with a rod, sheave, chain, and hook, as to make a simple pole support, wholly removing the weight of the tongue from the necks of the horses, and it may be disconnected readily when it is desired to let the tongue or pole down on the ground.

A nest box for fowls has been patented by Mr. William Z. Allen, of Monrovia, Ind. The object of the invention is to prevent hens while on their nests from being annoyed by other hens, or by rats, weasels, or other animals, a balanced nest being combined with and operating a hinged door, with which is connected a vertically sliding locking bolt.

A cooking stove has been patented by Mr. Ernst J. Krause, of Carlisle, Pa. A detachable partition plate, in combination with a horizontal stop plate, is so arranged as to check and control the fire, by reducing the capacity of the fire pot, so as to limit the heat to the smaller requirements of a stove for summer use.

A breech-loading fire arm has been patented by Messrs. Pius and Charles Kaul, of Lancaster, Pa. This invention covers a novel construction in which the breech is opened and closed by means of a vertically sliding block, a lever being adapted to pull down the block and cock the hammer by a single downward or rearward movement.

A folding table has been patented by Mr. John McGrath, of New York city. It has hinged legs connected in pairs by cross bars, and held in place by spring pressed brackets, so the legs will be held both folded and unfolded, for convenience in storage and transportation, and when opened for use the table will be firm and rigid.

A flying target has been patented by Mr. Charles F. Stock, of Peoria, Ill. This invention consists in providing that class of targets known as "clay pigeons" with a separate re-enforcement of paper, leather, or wood, applied to the edge or flange, so the target may be made very thin and fragile, and yet thrown from the trap without breaking.

A dust pan has been patented by Mr. Salathiel C. Sweetson, of Island Falls, Me. It is formed of sheet metal, with its side edges bent to form flanges, one higher than the other, the lower flange having its lap edge beveled from rear to front, so that it can be used for cleaning dust out of angles, and dropping the same into small openings in a stove.

A tool for raising sucker rods from wells has been patented by Mr. Marvin Newton, of Knapp's Creek, N. Y. The tube is made of spring metal, and has a slit so that the lower end of the metal will spring outwardly when passing a joint, its lower edge being formed as a steel cutter, so that it will pass around the pump rod, and cut off straps or rivets that may project.

A skidway has been patented by Mr. Joshua L. Given, of Philadelphia, Pa. The invention covers a special construction of skids, their lower ends to rest on a floor and their upper ends on a flight of stairs, shaped midway in a curve to which the two ends are tangent, to facilitate the sliding of merchandise from one story of a building to another.

A wind engine has been patented by Mr. David H. Bausman, of Lancaster, Pa. In combination with a horizontal wind wheel is an independent shield partly surrounding it, a vane connected therewith with a joint between the ends, devices for giving the parts of the vane the desired inclination to each other, with other devices, to make a simple and self-regulating wind engine.

A combined cotton chopper and scraper has been patented by Messrs. Samuel A. Myers and John J. Kelly, of Memphis, Tenn. This invention covers a special construction and combination of parts to facilitate the chopping of cotton plants to a stand, and the scraping of the rows of plants, and also to promote convenience in adjusting and controlling chopping and scraping machines.

A thermo-reservoir has been patented by Mr. Edwin D. Newton, of New York city. The invention covers a vessel adapted to hold hot water, with a coil extending downward from an upper vessel, the latter having at its lower end a cock projecting from the hot water vessel, so that mineral water stored in the upper vessel is heated by passing through the coil, the heating water being heated in a separate vessel.

A top for children's carriages has been patented by Messrs. Uriah McClinchie, of New York, and Jay F. Butler, of Williamsburg, N. Y. The invention covers a many angled bearing attachment to the parasol or canopy, in connection with a suitable locking device, thus making a clamp to hold the canopy in position on the rod or support which runs up from the carriage.

A piano-forte frame has been patented by Mr. Henry Kroeger, of New York city. Along all the edges of the back are bearing surfaces for the sounding board, and the frame has in one corner a triangular part with its inner surface flush with the bearing surfaces for the sounding board, the object being to promote the making of full, strong, and rich tones on the instrument.

An improved upper plate of copying presses has been patented by Mr. Henry N. Hubbard, of New York city. The water bowl is made in a convenient position on the top of the upper plate of the press, and the central boss socket for the screw of the press is strengthened by being formed on the face of the water receptacle, the upper plate, the bowl, and the socket being all cast in one piece.

An improvement in hand shears has been patented by Mr. Karl Witte, of Hartford, Conn. The invention covers an improvement on former letters patent issued to the same inventor, providing the handle loop for receiving the fingers with a lining of soft rubber or other material, and the handle for the thumb with a hard or soft rubber bow, for allowing a firmer grip without chafing the fingers.

An envelope for currency, checks, etc., has been patented by Mr. Charles A. Ball, of Delphos, O. A slotted metal strap and a covering or wrapper with an opening over the slotted part are so arranged as to make a convenient package for currency, notes, checks, etc., for shipment by express or otherwise, so the contents of the package can be counted without opening or withdrawing the bills.

A calcimeter, for treating cane juices in the manufacture of sugar, has been patented by Mr. Lucas M. Campi, of Havana, Cuba. The invention covers a longitudinal lime receptacle, graduated, and with a slide and screw, to enable any person, skilled or unskilled, to use the exact quantity required to clarify or defecate the cane juice, without having it a matter of chance or guesswork, as heretofore.

An irrigating apparatus has been patented by Mr. William R. Chisholm, of Laredo, Texas. An inner water pipe has nozzles projecting from its inner and outer surfaces, in combination with an outer pipe or casing inclosing the outer ends of the nozzles, the outer pipe having water passages in its ends, and the apertures varying in size according to the head of water, the whole making an apparatus not likely to choke up.

A saw has been patented by Mr. Walter Peak, of Peakville, N. Y. The teeth of the saw blade are made vertical upon their forward edge, with a cutting edge made by inclining their backs at an angle of forty-five degrees, their forward edges having V-shaped grooves, and in swaging the ends are thus formed outwardly, thus making a tooth that cuts both ends of the kernel at once, and will take out the kerf, clearing itself better than the common types of saws.

A rudder holder and support has been patented by Mr. Charles A. Richardson, of Alpena, Mich. A bed plate is fixed to the vessel and a collar on the rudder post, tongued and grooved together to hold the rudder firmly in place while permitting its easy movement, and so the post and its casing are protected from wear and leakage, and the lower bearing shoe of the rudder is or may be relieved of downward strain by the weight of the rudder.

A vacuum pan has been patented by Mr. Lucas M. Campi, of Havana, Cuba. This invention covers such construction of the dome and receiver that a steam and air tight joint may be formed between them, with various improvements in construction, so the evaporating of cane juice will be greatly accelerated, the operation be almost continuous, and the juice so evaporated down that in cooling the whole mass will crystallize, leaving practically no molasses.

A lime kiln has been patented by Mr. Bernhard Albers, of Conception, Mo. The base of the chamber of the kiln has rounded convergent shoulders, the chamber having ledges below the outer edges of these shoulders, upon which is supported a fire grate, thus providing a more effective combustion of fuel mixed with limestone than is obtained where the fire bed extends over the whole area of the chamber on the floor of the kiln.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at the office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) C. W. G.—We do not think the application of compressed air in the manner proposed will be a success. Better apply your manual power direct to the screw or propeller.

(2) C. E. M. writes: I am building steam launch 16 feet long, 40 inches beam. Boat will weigh only 150 pounds, engine and boiler 200 pounds; cylinder 2x3, 100 pounds steam, 500 revolutions. What size propeller shall I use, and how many blades, and give probable speed of boat? A. About 18 or 20 inches diameter, 3 blades; speed probably 6 miles per hour.

(3) F. F. W. writes: I have a steam launch which has a boiler of about 30 inches in diameter, 4½ feet high. The gauge glass on it is 14 inches long. Now, can you tell me why the glass breaks, one nearly every day or two? It is five-eighths of an inch in diameter, and it cracks when the steam is between 40 and 90 pounds pressure. A. Perhaps on account of currents of cold air striking the glass. Protect your glass by a screen made of sheet tin, copper, or brass.

(4) P. S. M. asks: Are not V-cone pulleys and round belts as powerful as flat belts on light machinery, and would they not be better for foot lathes? A. V-cone belts—jointed belt built up in this shape—are used to some extent in places where a large amount of power has to be transmitted, and there is not room for a large flat belt, but these belts are not considered as efficient as flat belts. In light machines, such as sewing machines and those of similar requirements for power, round belts are used on a pulley with channeled face, with perhaps as good or better effect than the same weight and strength of leather would give if flat, but the object is rather to serve convenience in construction than gain power.

(5) J. F. M. asks why a steam pump working with forty or fifty pounds of steam will not pump water against sixty or higher pressure. A. It will pump against 60 or 100 pounds pressure if properly proportioned.

(6) R. F. H. asks: 1. In making a dynamo half as large again as the one in SUPPLEMENT, No. 161, so that the armature and field magnets will be six inches long, what sizes silk covered wire should I use to obtain the greatest electric lighting power? A. That depends somewhat on the manner in which you intend to use the dynamo. If for an arc light—which will give the greatest illuminating power—it would be best to wind the armature with No. 18 wire. 2. About what candle power would such a dynamo have? A. Probably 12 or 15. 3. How much power would it require to drive it? A. About one-half horse power

(7) G. M. G. asks: Is there any kind of paper, or anything, that upon a current of electricity passing through it, it will change its color? A. Ordinary paper dipped in the following solution changes to blue color when a current of electricity passes through the paper: Nitrate of ammonia 2 pounds, muriate of ammonia 2 pounds, ferricyanide of potassium 1 ounce, water 1 gallon.

(8) J. B. D.—Hydrochloric acid will clean off the rust scale better than sulphuric acid. Any acid is rather troublesome to apply to the inside of a keir. Pieces of sandstone or broken grindstone are very good to rub off the rust with, but will not reach the corners and seams, or around the rivets. A file with the end broken off, used as a scraper, will work in the corners and seams.

(9) A. W. B.—There is nothing that can be added to sodium silicate or water glass to prevent its dissolving when water is poured upon it. A coat of varnish over the dry coat of the silicate will naturally help to preserve it.

(10) J. T. B. S. writes: 1. I want some apparatus that will show the vibrations, or rather count the vibrations, of plates of wood or metal, so as to determine their relative pitch and qualities of vibration, and show them to the eye. Can you help me? A. Arrange a very light but rigid lever to amplify the vibration. Provide the lever with a needle point, and make your tracing on a cylinder carrying enameled paper smoked to receive the impression. 2. Can carbons for arc lights be made of different grades of conductivity, so that one will last longer than the other, say in the proportion of 1 to 2, or 1 to 1·5? A. They can be made of varying conductivity, but the light will vary also.

(11) W. E. V. writes: 1. A claims that a vessel sinking at sea does not sink to the bottom, owing to the density and pressure of the water underneath, but only sinks to a certain depth, while B claims that a vessel going down at sea will certainly reach the bottom of the ocean. A. There is great pressure at the bottom of the ocean, owing to the weight of the water above. Water is so slightly compressible that there is very little additional density at great depths. Everything that will sink will go to the bottom of the ocean, unless it is porous and contains air that may sustain it for a while, or until the air becomes absorbed by the water. The great pressure soon watersoaks all woody substances when carried to the bottom by being attached to denser substances. 2. Haswell gives as the estimated depth of the Atlantic, 26,000 feet; depth of the Pacific, 29,000 feet; and the depth of the course of the Atlantic cable varying from 20,000 to 18,000 feet. Is the latter depth (18,000) estimated, or taken from actual soundings? A. The cable soundings were actually made. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 433 and 434, for an interesting account of deep sea work. The sea is filled with animal life at great depths. Fishes live at from 3,000 to 13,000 feet below the surface, where the pressure may be as great as a thousand to fifteen hundred pounds per square inch, and how much greater we do not know. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 437.

(12) C. M. G. writes: I have a magnet of five-eighths square steel, horseshoe pattern; have tempered and charged it as directed in SCIENTIFIC AMERICAN SUPPLEMENT, No. 266, that is, I have wrapped it closely with fine insulated copper wire and placed it in the circuit of a 40 lamp power (Brush) generator, running full capacity. The charge received in magnet is not sufficient to lift its own weight. What is the cause of so slight a charge, and how can I obtain a charge of magnetism in this magnet sufficient to lift ten pounds or more? A. It would be difficult to point out the cause of your failure without knowing more of the details of the experiment. Your wire may have been so fine as to offer too much resistance to the current. Your steel may have been either too hard or too soft, or it may have been of a kind poorly adapted to the purpose. Try chrome steel, and use coarse wire for your coil. 2. What is the cause of one pole being stronger than the other? A. Probably some defect in the bar or in its temper.

(13) F. A. B. asks: 1. If I buy an incandescent lamp, is there any patent to prevent my using it when I choose, or must all lighting be under control of patentee? A. We understand that one at least of our largest electric lamp manufacturers furnishes lamps, and with them the privilege of using. 2. Why will not a plunge chemical battery furnish current for incandescent lamp? A. Such a battery composed of a sufficient number of elements will furnish the current; but the expense and trouble will be great.

(14) F. W. J. asks: What kind of lining can I put into a steam box so as to have it air tight and not cut out? Have used both zinc and galvanized iron, and both have failed. A. Wood is generally used for steam boxes, especially for steaming wood. The ship builders use 2 inch pine plank held together with outside frames and bolts.

(15) F. E. W. asks: Is there any process for depositing 8 or 10 carat gold by the electrical process for practical purposes? If so, will you please give the formula and describe the process? A. See SUPPLEMENT, No. 310.

(16) J. F. N.—On page 937 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 59, is given a process for bleaching soap; it may be suitable for your wants. We should think, however, that the most satisfactory way would be to bleach the resin with which your soap is prepared. Tin crystals are the stannic chloride or perchloride of tin, and are largely used in dyeing and calico printing. The preparation consists in dissolving granulated tin in hydrochloric acid and evaporating the solution.

(17) F. L. writes: Some time since I sent to you for SUPPLEMENT No. 161, containing instructions for making a dynamo electric machine. I made one, and cannot get it to work, except with the aid of 2 or 3 cells of Bunsen battery, and then it gives only a very weak current. A. As a large number of successful machines have been made by different persons in different parts of the country from the directions given, we conclude that the fault is yours. Try changing your commutator; try reversing the wires running to your magnets. You ought to succeed.

(18) J. E. asks: How can I caseharden small wrought iron objects, such as small set screws? A. Take a length of gas pipe of from 6 to 12 inches and of suitable diameter, screw on thimble caps, and pack the screws in them with bone dust, or with equal parts of charcoal dust and unslaked lime; heat to a red for two hours, then chill in cold water. A charcoal or a coke fire is best; anthracite will do, but bituminous coal is objectionable.

(19) A. B. writes: I see in your paper of May 3, a view of the Quaker dam as contemplated. As apparently the shores are rocky, would not, in-tead of the straight dam, a horizontally curved one, with apex against the water pressure, form a lighter, stronger, and cheaper construction? A. No.

(20) H. B. R. asks: What would be the best material and proper dimensions to make a spline 30 feet long, to lay off the draught of a boat? A. Straight grained cedar or fine grained white pine, say about three-eighths inch wide and three-sixteenths to one-quarter inch thick.

(21) F. B. asks if it is necessary to get two or three engineers to sign application papers when applying for engineer's license. Also where and what places in Minnesota is it necessary to apply to be examined for license, and what are the fees for the same? A. We think there is no rule as to the number of engineers signing the application. We do not know what the State law of Minnesota is in respect to engineers. If you wish to obtain a license as a steamboat engineer, you must have license from United States Inspectors. You can get information by addressing Mark D. Flower, St. Paul, Minn., Supervising Inspector of Steamboats.

(22) J. B. Z. writes: In *Harper's Weekly*, in giving dimensions of steamship Oregon, it says, length 520 feet, 84 feet beam; would you be kind enough to answer through your paper if 84 feet beam means the actual width of the ship, and is the Oregon that wide? This part is in dispute, left to you to settle. A. This is an error; it should be 54 feet beam, not 84 feet; 54 feet is the actual width of the vessel.

(23) H. L. C. writes: I have made a dynamo electric motor for running sewing machines; am using 3 cells, 4x6x8 carbon battery, but would prefer a single fluid battery. What is the best form of battery for the purpose—the common Smee battery or a carbon and zinc? What fluids are used in the carbon and zinc battery, with single fluid? A. With carbon and zinc battery use the bichromate solution, which has been repeatedly given in these columns.

(24) H. M. H. asks: 1. How can we test wall paper, cloth, etc., for arsenic, in some simple way? A. To identify the presence of arsenic in wall paper, dissolve the coloring matter off in a little ammonium hydroxide, pour off this solution on a piece of glass, and drop into the liquid a crystal of silver nitrate. A yellow coloration around the crystal indicates the presence of arsenic. This will answer as a general rule, but it is only a rough test. 2. How can we test water from a well to determine if it is injurious for drinking? A. See answer to query No. 18, in SCIENTIFIC AMERICAN for March 29, 1884. 3. How is the fine black polish got on carbon contacts in transmitters? Have tried on all kinds, both hard and soft, and cannot do it; they look as if varnished. A. Polish the carbons by rubbing them on sheets of very fine French emery paper. The emery paper to be placed face up on a hard bevel surface. The French carbon is best. 4. Is cast brass or gun metal as good for the frame work of transmitters as cast iron? A. Brass will do. 5. Also please give directions for making fluid for bichromate of potash batteries. A. You will find this given in several of the recent numbers of the SCIENTIFIC AMERICAN in the Notes and Queries columns.

(25) W. C. M. asks: Could the exhaust steam from a 35 horse power automatic cut-off engine, Hampson patent, which is only working up to 15 horse power, be used for heating to carry the exhaust 125 feet underground, and then through 13 small radiators situated on three floors? How should it be connected? What amount of back pressure would there be? A. Your exhaust steam can be utilized for all it is worth. In leading it so far underground care must be taken to box the pipe, so that it will retain as much heat as possible, putting a drip at the end. Use three inch main, and make all the branches to the various radiators so that the aggregate area or opening shall not be less than the main pipe. The drips from the radiators should also be nearly the same area as the main, and open freely. You can then heat all the radiators with very little back pressure, say half a pound to the square inch. If well proportioned, with ample outlet, you may accomplish the work with a quarter of a pound back pressure.

(26) W. F. B. asks a simple way of cleaning and roughening or recutting old mill saw files—a dip or solution of some kind. A. Old files are sometimes put to additional service by boiling in strong soda or potash water to clear them of grease or oil; scrub all dirt and filings from the teeth with a wire brush, rinse in hot water, then dip for 10 to 20 minutes in a bath of nitric acid 1 part, water 4 parts. You must use your judgment by inspection as to the exact time, and should also in regard to the exact strength of the bath. A coarse or bastard file will stand a stronger bath than a second cut file. This process is very little used here; there are parties who recut files in the regular way.

(27) D. J. R. asks: How will it answer to put a circulating boiler for bath tub into the cellar, running the pipes to a hot water back in the room above? Will there be danger of an explosion, or will the hot water circulate downward to the boiler from the range, and the cold water rise from the boiler to the range? A. Your plan will not work. There will be no circulation. Put the boiler in the same floor with the range, and draw from the top into the bath; make the cold water connection into the bottom of the boiler, and have the pipe open to the reservoir or water supply, so as not to produce undue pressure from overheating when the hot water is not required for use. Care should also be observed in making the connections between the waterback and the boiler so as to insure circulation.

(28) W. J. M.—The lacquer blisters because the tubes are not heated before they are lacquered. The solution for platinizing is platinum chloride, and it is put on the plates by means of electricity or electro deposition. As to the silver plate being hard or soft, it is immaterial. The composition of the alloy is of no consequence. The soldering fluid is made by dissolving as much zinc chloride as possible in a pint of alcohol, and then adding 1 ounce glycerine. Carbon itself is about as hard a material as can be procured. Manganese dioxide is stable, and will not change. The Leclanche cell will last six months if properly taken care of.

(29) J. E. S. asks how the small corundum wheels used by dentists are made, and how, if moulded, they are prevented from sticking to the mould. A. We believe that the wheels are prepared by using the ordinary ground emery, and caking in plastic moulds to such a degree of heat that the corundum solidifies into the given shape. The mould is then broken off.

(30) M. L. P. asks how to temper small steel springs, such as plain springs, for gun and small ratchet springs. A. Where gun lock springs are made in quantity, they are packed in iron boxes with pulverized charcoal and sand, heated to a full red, and dumped into a trough of oil. For a single spring this is not necessary. Cover the spring with a little soap and powdered charcoal to keep it from scaling, heat to a cherry red in a charcoal fire slowly, by cutting down the blast; when evenly heated dip in lard oil. Clean and polish, then draw to a light blue by holding over the fire until the color is obtained.

(31) B. Y. Y. asks: Is there any circulation of the water in a steam boiler, when steam has been generated so the gauge shows 25 inches pressure, when all the valves are shut off and no steam escapes or is drawn off; and if there is any, will the increase of pressure increase the circulation; and if the circulation only takes place when the steam is drawn off, where will circulation be the greatest, if much or little steam is drawn off? A. There will be circulation as long as steam is generated. The more rapid the generation, the greater the circulation. If steam is drawn off more or less rapidly, the circulation will be increased. The direction of the circulating currents will depend upon the design or character of the boiler.

(32) C. W. T. asks for a liquid composition of an adhesive nature, that could be applied to any kind of paper, and when dried by hot air will make the paper hard and tough. A. Flour paste is much used by book binders for fastening sheets of paper or paper and cloth together. This may be made much stronger by the addition of a small quantity of glue. Starch is also much used for mounting where clear work is required. A little white glue added to the starch strengthens it. A little gum tragacanth in the paste or starch also strengthens, and makes clean work. The sheets should be pressed if you require flat work.

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Tobacco, smoking and chewing, G. W. Gail & Ax 11,194

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