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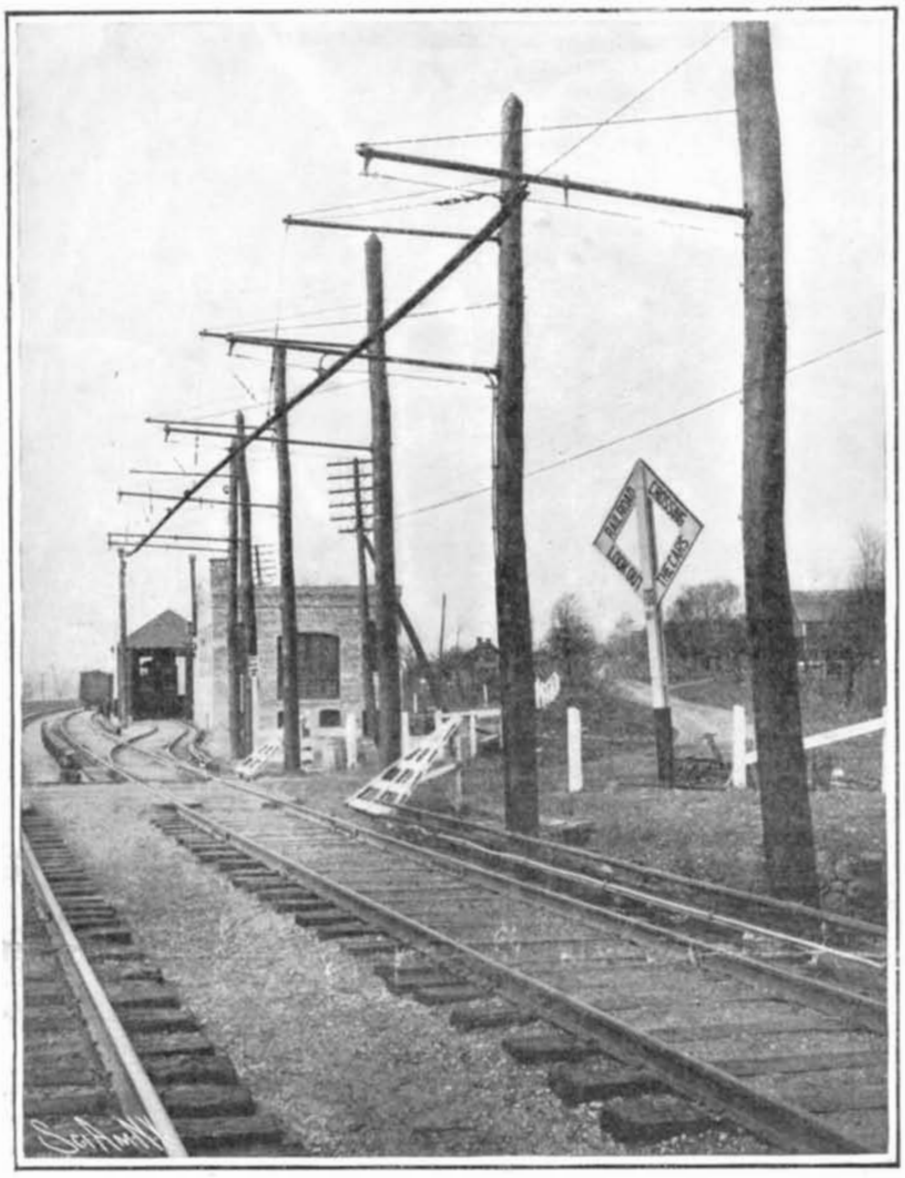
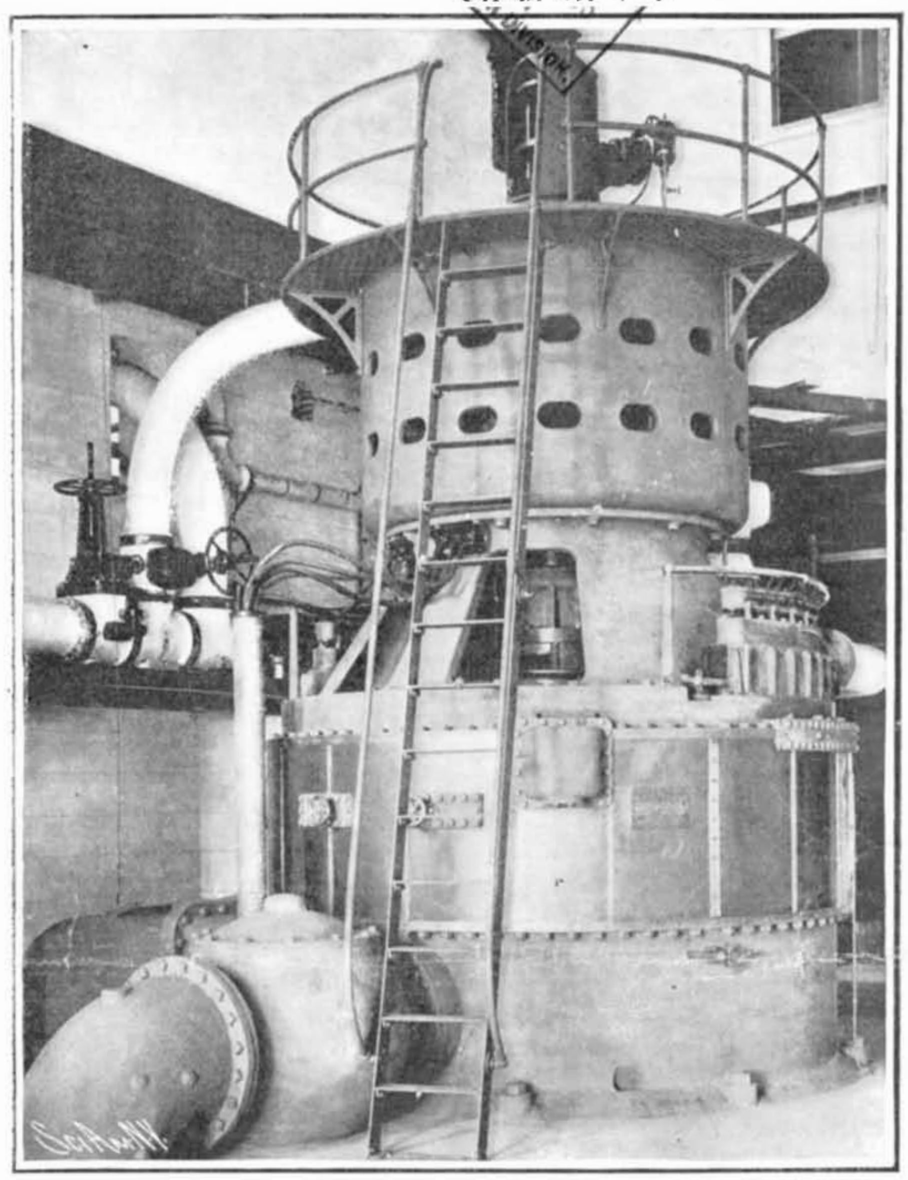


Experimental Track, Showing Third Rail; Overhead Conductor at Crossing; and the Substation.



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ELECTRICAL EQUIPMENT OF THE NEW YORK CENTRAL RAILROAD. - [See page 142.]

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NEW YORK, SATURDAY, FEBRUARY 18, 1905.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE OLD AND THE NEW.

In the broad field of engineering there is no single section that has had so much to do with the industrial growth of the world as the steam railroad. Furthermore, in all the seventy years of its growth, the steam railroad has never witnessed a change so radical, or destined to work such far-reaching results in promoting its development, as the impending substitution of electricity for steam in the operation of its trains.

By far the most important work being done in this connection—and we say it with full recollection of the pioneer work in the electrical equipment of some roads in Europe—is the wholesale substitution of electric for steam traction, which is now being carried out on the New York Central terminal, suburban, and express lines; for this is the first time that the problem of working all trains, express as well as local, by electric power, has been attempted. For, mark you, this is no mere experiment, carried out by some up-to-date but impecunious individual or company, upon a scale too limited to render the results of practical value. It is an experiment—if you please to call it such—that involves the reputation of the largest railroad system in the world, and forms the principal element of cost in changes that call for the expenditure of $50,000,000.

The success of this installation, of which there can be no doubt whatever, marks the first step in the gradual substitution of the electric for the steam locomotive in the operation of long-distance express trains. Very gradually will the change be made, and the electrical hauling of through expresses must ever wait upon the equipment of the local service. The enormous improvement in the latter, due to shorter, more frequent, and faster trains, will call for its continuous extension to other parts of the system. The New York to Croton equipment will be followed by an Albany to Hudson service; to be followed, in turn, by extensions of these circuits, say to Rhinebeck and Garrison, respectively. The next extensions would bring the two services to a connection at Poughkeepsie; and so the through electrical service from New York to Albany will be completed. Similar extensions, east and west from Chicago, Cleveland, and Buffalo, will in time link Chicago with New York.

But it must not be supposed that the steam locomotive, which must ever be reckoned as one of the most perfect mechanical inventions of any age, is destined to pass entirely from our midst. Only on lines that have a fairly heavy traffic can the electric locomotive compete with its older brother. For the steam locomotive carries its own power station; it does not depend for energy upon a power plant located many miles away; it does not have to string out behind it a costly copper transmission wire; nor does it necessitate the building of many substations along the track, wherein its life-giving food may be transformed, and converted, and otherwise doctored, so as to prepare it for easy digestion. Where stations are far apart, traffic light, and freight a scarce commodity, the whistle of the steam locomotive will long be heard in the land.

By the courtesy of the officials of the New York Central Railroad, we were recently given an opportunity to ride, during the same day, on the latest type of express steam locomotive and on the new electric locomotive, both of which are designed for the same class of service. In each case the load behind the engine was the same, and a unique opportunity was thus afforded for comparing the old with the new. The steam locomotive was the new balanced compound, recently exhibited at St. Louis, where it was tested on the Pennsylvania Railroad Company's testing plant. She is probably the most powerful express engine in existence, and she represents in her four balanced cylinders and connections, the most advanced ideas of our locomotive builders. Probably she marks the limit of size, power, and efficiency of the fast express type. When the engine was running at speed, the absence of vibration and concussion, as compared with the simple Atlantic type, was remarkable, although in this respect she could not, of course, compare in smoothness of running with the electric locomotive—the latter having no reciprocating parts whatever. The acceleration, when hauling the same weight of train, was markedly slower than that of the electric, and the sense of reserve power in the latter was made evident by the ease with which she "got away" with her load.

It is the figures, however, that tell the story; and here they are: The steam locomotive, on a total length of 62 feet and a total weight of 162 tons, can develop a maximum horse-power of 1,800; but the electric locomotive, on a total length of 37 feet, and total weight of only 95 tons, can develop a maximum horse-power of 3,000; or 31.5 horse-power per ton, as against 11.1 horse-power per ton. Again, the starting pull of the electric locomotive is 32,000 pounds, while that of the steam locomotive is 25,900 pounds. As the speed of the latter increases, the pull falls very rapidly, until—as shown on the testing plant at St. Louis—it is only 9,800 pounds at 56½ miles per hour, and 5,200 pounds at 75 miles per hour. This drop is largely due to back pressure of the steam—the difficulty of getting rid of the large volumes of steam that must pour through the cylinders when the engine is running at high speed. No such drop in the drawbar pulls occurs on the electric locomotive, which can keep on accelerating a train, long after the steam locomotive, when hauling the same weight of train, has reached its limit.

The elaborate tests now being carried out on the main tracks of the New York Central near Schenectady, are to include some literal "races" between similar trains running side by side, the electric on the local, and the steam trains on the adjoining express tracks. Thus, an Empire State express train, hauled by a steam locomotive, will start from rest on the express track, side by side with an exactly identical train hauled by the electric locomotive on the local track. Then we shall know exactly by how much the new excels the old system of traction, in point of hauling power and speed.

WIND PRESSURE ON BRIDGES AND BUILDINGS.

Many of us will remember the terrible accident on the Tay Bridge in Scotland, when, on a stormy night in midwinter, several spans were blown over into the estuary, carrying with them, caged in the steel trusses, a whole trainload of passengers, of whom not a soul escaped to tell of the disaster. The wrecking of this bridge afforded, or rather was supposed to afford, proof that engineers had greatly underestimated the overturning power of the wind. As a matter of fact, the bridge collapsed because of poor castings in the piers of the bridge, and the faulty manner in which they were braced. Nevertheless, the British Board of Trade, which takes cognizance of all accidents involving loss of life, laid down a sweeping law to the effect that in calculating the wind pressure on future bridges, a unit of wind pressure much higher than any previously used must be applied. The great Forth Bridge was then in contemplation, and before the plans were allowed, it was decreed that wind pressure must be allowed for at the rate of 56 pounds on every square foot of the surface of the side elevation of the bridge. The wind stresses were calculated accordingly, with the result that this noble structure is, and forever will be, the most massive and heavily braced bridge of large span in the world. As a matter of fact the wind bracing is much heavier, as subsequent tests have shown, than it need have been. Thus, Sir Benjamin Baker, the engineer of the bridge, gives the following stresses per square inch existing in the bottom members of the Forth Bridge, for the weight of the bridge itself, for the weight of the train, and for the wind pressure: the dead load of the bridge imposes a stress of 2.8 tons per square inch; the live load of the trains imposes a stress of 1.2 tons per square inch, while the calculated wind stresses amount to 3.5 tons per square inch. But since much of the dead load stress is due to the great amount of material worked into the bridge to resist the wind stresses, it follows that in this bottom member the stresses due to the wind, as calculated, account for more of the material than do the dead load of the bridge and the live load of the trains combined.

Now it is well understood that the excessive allowance for wind stresses was imposed on the engineers by the Board of Trade, and was not determined by their own judgment. At the time that the bridge was designed, however, reliable data as to wind pressures were wanting, and indeed, the first really reliable information of the kind that is now accepted by bridge engineers was acquired by the engineers of the Forth Bridge during its erection. Mr. Baker caused pressure gages of large and small area to be erected, and careful records of wind pressures made for a period of several years. The results obtained proved that such a thing as an absolutely even and uniform pressure over any large area affected when a strong wind is blowing is a thing unknown, the wind acting with pressures of widely varying intensity on surfaces that are adjacent or almost adjacent. Thus, the unit pressure on a gage at the Forth Bridge measuring 15 x 24 feet was only about 66 per cent of the unit pressure recorded on a gage having an area of 1½ square feet; and there is no doubt that on a gage measuring 100 x 100 feet there would have been a still greater reduction in pressure per unit of measurement. It is well established that the accepted formulas for determining wind pressure are much too high, being based on maximum pressures recorded on small areas. Thus Theodore Cooper, whose specifications for bridges are standard throughout America, is of the opinion that a pressure of only 25 pounds per square foot acting at the same moment on large areas would denude the district affected of all trees and buildings; and General Greely, of the United States Signal Service, has stated that there have been few cases recorded of wind velocities in the United States, where the pressure exceeded 16 pounds to the square foot; this, of course, being taken to mean 16 pounds over wide areas. The enormous pressures of which we have evidence in the destructive effects of a tornado, are now understood to extend over comparatively limited areas, not exceeding a few hundred feet at the widest. In an exhaustive study made of the St. Louis tornado by Julius Baier, it was stated that there was evidence of pressures as high as 60 pounds to the square foot, but that they extended over a breadth of not more than 180 feet. Another noted bridge engineer found, after following up and investigating the paths of several tornadoes, only a single case where a width of 60 feet was not sufficient to cover the path within which the estimated pressures exceeded 30 pounds. From this it follows that on spans of over 150 feet, the average pressure to be assumed in calculating the necessary strength of the wind bracing may be reduced, the reduction increasing with the increase in length of the span. Mr. Cooper, than whom there is no greater authority on this subject, suggests the following wind forces as sufficient to cover all cases: First, a wind force of 50 pounds per square foot, acting at the same moment over a width of 60 feet, striking any part of the bridge at any angle, within 30 degrees above or below the horizontal; second, a wind force of 30 pounds over a width of 600 feet; and third, a wind force of 15 pounds over a width of 2,000 feet; the maximum stresses from either of these requirements to be used for proportioning each member. Now, there can be little doubt that these estimates are perfectly adequate to meet the conditions of the severest storms, even of those of a cyclonic character. Although comparatively small areas of a 2,000-foot span might be exposed to the impact of a tornado that would tear the buildings of a city to pieces, the total pressure on the whole span at that instant would not rise much above that due to a steady wind of high velocity, but free from tornadic action. If we compare the pressure of 15 pounds per square foot over a width of 2,000 feet with the pressure of 56 pounds to the square foot, imposed upon the engineers of the Forth Bridge on a length of 1,700 feet, we can understand what a vast amount of unnecessary material was worked into that structure because of the heavy conditions imposed with the best intent by the Board of Trade. Were the bridge built at the present time, subject to the more accurate knowledge that we possess, its cost, due to the reduction in wind bracing, would be very materially decreased.

A large iron works has been erected by the Japanese government at Wakamatsu. When completely finished, it is to have an extensive blast furnace plant with all the necessary appliances, besides a steel plant for Bessemer steel and a second for Siemens-Martin steel. The latter is to be equipped with a number of sets of rolls. The plant is, however, far from being complete. In 1903 it turned out some 35,000 tons of finished product. The works uses coal which it obtains from three mines. The latter are worked in connection with the plant and lie 20 miles distant. Ores from different parts of the country are used, and a considerable quantity is brought from Corea and China, especially the latter. The cost of producing a ton of cast iron is stated to be $15 at present. It is expected to reduce this price by eliminating the ore which is sent from China, as this has a high price, and a ton of iron may soon be produced for $11. This will be $2.40 lower than foreign cast iron, which is obliged to pay a customs duty of 80 cents per ton. It is considered by those who are acquainted with the subject, that the difference in price between the home and foreign products is too small to allow the Japanese product to support the heavy charges coming from the first cost of the plant. These charges were not counted in the above price. The expense of installing the plant has been considerable, and is figured at $15,000,000. The government, according to some authorities, intends to turn the plant over to a Japanese company with foreign capital at a price which is only half that mentioned.

THE PROPOSED RAILROAD TO KEY WEST.

One of the most interesting chains of islands off the American coast is the Florida keys, of which Key West forms a part. They constitute a chain of land links stretching out into the ocean from the mainland, and forming the passage known as the Florida Straits. A glance at the map shows that they are separated from one another by channels varying from a few hundred feet to several miles in width. In fact, between some of the keys the distance is so great that it would seem impossible to connect them with a bridge or other structure, but this is what is to be done, for engineers have recently completed plans and surveys for what is undoubtedly the most notable feat in railroad engineering which has ever been conceived —the construction of a railway to Key West by means of these islands. It will form an extension of the Florida East Coast Railway, which as its name indicates skirts the eastern coast of the State named. At present it terminates at a station twenty miles south of Miami, and on the border of the Everglades. Consequently, to lay the track to the nearest key, it will be necessary to construct a considerable mileage through this swamp; but between the coast line and Key Largo, the nearest island, no less than twenty miles of salt-water marsh intervene, which must be spanned by trestlework.

During the last two years, a corps of engineers in charge of Mr. E. Ben Carter, of the Florida East Coast system, have been making an exhaustive investigation, to determine if the extension was practicable. The territory between the southern terminus of the railway and the coast line, as well as all of the keys, and the waters separating them, have been carefully examined, with the result that the extension has been deemed possible. But before Key West can be reached, it will be necessary to build 120 miles of railway on the keys and over the sounds and other passages separating them. In all, twenty islands are available for the extension, but no less than 40 miles of elevated work must be built above the water, not counting the trestling between Key Largo and the mainland.

Fortunately, the formation of the keys lends itself to the project. Rising but a few feet above the surface of the water, it consists of coralline rock offering a level and smooth surface after the few feet of soil which has accumulated on the rock has been removed. But a minimum amount of grading will be required, and an abundance of ballast is available in the form of pieces of the rock which is found on all of the keys. The fact that the same formation lies beneath the intervening waters renders the scheme feasible in the opinion of the engineers, for it offers a sufficiently firm foundation into which the supports of the bridges and other work can be set. The depth of water, however, ranges from 3 to 18 feet, since several of the passages are navigable for vessels of this draft. The deeper channels will of course be spanned by drawbridges, and it is proposed to support them on piers of masonry at a sufficient elevation above high tide. By far the most extensive marine work will be between what is known as Bahia Honda and Knight's key. These islands, located about midway in the series, are no less than 8 miles apart, the water varying in depth from 6 to 18 feet. At this point the reef which extends along the Atlantic side of the keys for such a distance is broken, and a considerable mileage of the structures will be exposed directly to the open sea. A number of other passages vary from one to three miles in extent.

Several methods are available for supporting the elevated work, but with the exception of the bridges, it is probable that steel posts or piling will be utilized entirely. The metal below the water must be protected by incasing the pillars in wood, which has been treated to a preparation of creosote, which in turn will prevent the wood from being damaged by the teredo.

Upon the keys and adjacent waters over 100 miles of railway will be required, not counting the trestle connecting with the mainland and the portion which must be built through the Everglades to the present terminus of the line. The total length of the extension is estimated at nearly 140 miles, and when completed it will undoubtedly be one of the most expensive pieces of railway construction in the world. Nothing approaching the marine work has ever been attempted. The Third Avenue railroad on Manhattan Island is slightly longer than the section to be built between Bahia Honda and Knight's key. The Lucin cutoff, by which the Southern Pacific system crosses Great Salt Lake, comprises 26 miles of trestlework; while the New Orleans and Northeastern Railroad crosses Lake Pontchartrain on a structure which is 8 miles in length; but both of the latter are merely wooden trestles, and offer no parallel to the marine construction which must be carried out on the Key West line.

The building of this extension, however, will give the railroad in question access to one of the finest harbors on the American coast, that of Key West, which has a depth of 33 feet in the main entrance. The harbor is accessible by four different passages, and is sufficiently commodious to accommodate a considerable fleet of ocean-going vessels. It is understood that one reason for building the extension is to establish a transfer service between Key West and Havana, so that freight can be shipped from this country to Cuba by the carload without breaking bulk *en route*. Havana is about 90 miles from Key West, and a car-ferry steamer having a speed equal to the ferryboats on the North River could readily make the round trip in a day of ten hours. In connection with the Panama Canal, however, Key West possesses special advantages, as it is actually 250 miles nearer the Gulf entrance to the canal than any other city in the United States. Consequently, with railroad communication, it would offer special facilities as the port for lines of steamships to the American and Asiatic Pacific coast, as well as the islands of the Pacific.

GAS ENGINES FOR FACTORY POWER.

BY G. MEYNELL.

Until very recently the installation of gas engines for factory purposes was of a very limited scope, owing to several reasons.

First, the gas engine was unknown to the average engineer, and was therefore mistrusted in favor of the old reliable steam engine.

Secondly, gas engines were only offered to those parties utilizing a very small quantity of power, say 25 horse-power or less, owing to the fact that the cost of fuel, be it either city gas or gasoline, proved prohibitive beyond this size. The reason for this was that in sizes of 25 horse-power and less the gas engine could be trusted to operate without the supervision of an engineer, and therefore the owner was enabled by cutting the engineer's salary expense, to pay the comparatively high rate per horse-power hour called for by the gas engine, and yet save considerable money on the transaction.

This limited use of the gas engine might have continued indefinitely but for the introduction of two widely separated industries, the automobile and the gas producer industry respectively.

The first of these two was beneficial, inasmuch as it familiarized the public at large with the operation and consequent attention of the gas engine. The second industry has supplied a means whereby gas for power purposes may be generated at so low a figure on one's own premises that gas engines can be operated, even in very large units, at figures which show a vast economy in fuel over the present steam engine.

From the foregoing it will be noted that the gas engine operated on city gas is a practical paying investment for power service up to about 25 horse-power, owing to the elimination of salaries; and that in order to entertain the gas engine proposition beyond this point, it becomes necessary to look about for a cheaper form of gas.

In gas-engine rating, the power consumed, irrespective of the type of gas employed, is figured on the number of heat units required to do a certain amount of work, which has standardized itself, so that now the majority of gas engines will deliver a brake horse-power-hour for 12,500 British thermal units, or B. T. U., as they are usually termed. It is immaterial, as far as the working of the engine is concerned, whether these 12,500 B. T. U. are supplied in the form of a rich gas, such as illuminating gas, of 600 B. T. U. per cubic foot, or are supplied in the form of weak blast-furnace gas of only 80 B. T. U. per cubic foot, provided that in the latter case the engine is equipped with cylinders of sufficient capacity to handle a larger quantity of the weaker gas.

With the above points in view, there has been introduced upon the American market a type of gas generator known, for the sake of brevity, as a "producer." This apparatus is a modified and greatly simplified gas-generating plant for the purpose of generating a weak form of power gas, especially designed and adapted for the use of gas engines. It is arranged in this apparatus that coal shall be fed directly into the hopper of the apparatus, the resultant gas being drawn off at the outlet as the needs of the engine may require.

This gas, while of only 135 B. T. U. per cubic foot, forms an almost ideal fuel for gas-engine purposes, for inasmuch as it is very low in hydrogen, it admits of the engine builders allowing for very high compression in their engines without fear of pre-ignition, while the resultant efficiency, owing to the high compression, is very marked.

The introduction of the gas producer upon the American market has been very gradual and not heralded by any great amount of newspaper talk; nevertheless, this industry has already obtained a firm foothold among our manufacturers, and it would seem that the time is not far distant when the comparatively wasteful steam engine and steam boiler will be almost entirely replaced by gas and producer-gas engine plants.

In addition to supplying a means for the practical operation of the larger sized gas engines, the gas producer has added an impulse to the large gas-engine trade which is very marked, for without a fuel gas of this description the sale of large engines was entirely restricted to the natural gas fields, while now it is practical to install a high-power gas-engine plant wherever coal and water are available, with the result that although until quite recently quotations on gas engines of 1,000 horse-power or over could only be obtained from European firms, at the present time of writing no less than six American firms have submitted estimates for such high-power engines.

Visitors to the St. Louis Exposition had the opportunity to observe this type of machinery in actual operation; for a concern that is a pioneer in this line of work, had in actual service two power plants, one for the operation of the gas-engine exhibits of one of our well-known engine manufacturers, while the other plant supplied gas for the testing plant of the United States government in "The Gulch." Both these plants operated continuously and satisfactorily during the Fair, and their small coal consumption served as an object lesson to those who compared the workings of these plants with similar steam equipments.

Generally speaking, gas producers can be depended on to furnish one brake horse-power-hour from $1\frac{1}{4}$ pounds anthracite pea coal, this type of fuel being the favorite for gas-producer work, owing to the fact that the resultant gas contains no by-products to be gotten rid of by special machinery.

It can easily be estimated, with the data now obtainable on the market, what the cost of an entire equipment of gas producers and gas engines, to replace a steam plant, would be; and while the first cost of the gas plant would appear considerably higher than the cost of a steam plant of the same capacity, the resultant economy would be so very great that it would pay a very high rate of interest on the money invested, and probably pay off the entire cost of the plant in about four years in addition.

In estimating on a gas-producer power plant, the owner should first ascertain the exact maximum amount of power which he will be called upon to deliver, for gas engines, unlike steam engines, have no overload capacity whatever. Again, he should satisfy himself as to the cheapest and most readily obtainable fuel in his locality, as the builder of a gas producer can supply him with several types of gas producers designed for various grades of coal, both anthracite and bituminous, obtainable on the market; and furthermore, the cost of the plant will vary materially with the fuel to be employed. For example, a hard-coal plant will be much less expensive than one of the same capacity for soft coal, as in the latter case there are hydrocarbons in the gas which have to be removed by mechanical washers, or they would condense in the form of tar and gum up the engine.

Among the plants of this nature which have been in service sufficiently long to satisfy the most exacting demands may be mentioned that of the Camden Iron Works, Camden, N. J., and that of the Erie Railroad Company, Jersey City, N. J. This latter plant has been in continuous service twenty-four hours a day for upward of five years since its installation, and indicates the thorough reliability of this type of plant when properly installed and efficiently handled.

THE CURRENT SUPPLEMENT.

The English correspondent of the Scientific American opens the current Supplement, No. 1520, with an article on gasoline locomotives and cars for railroads. The Paris correspondent writes on a new method of treating peat. Valuable formulæ for toilet specialties are published. A full, descriptive article appears on the auxiliary power yacht "Mollihawk II." A Berlin inventor has devised a speedometer for use on automobiles. The instrument is fully described and illustrated. Prof. Berthelot reviews very exhaustively recent researches on aerolites. Capt. Winkler's interesting article on the sea charts used by the Marshall Islanders is concluded. Prof. J. W. Pernter writes on methods of forecasting the weather. The "Isophone" is a microphone designed to form a new and powerful telephone transmitter. The instrument is fully described. Schloemilch's wave detector for wireless telegraphy is fully described by our Berlin correspondent. O. M. Peterson discusses the question whether there is African blood in the white races of Europe and America. The usual Electrical, Engineering, and Science Notes and Trade Notes and Recipes are given.

A PATENT DEDICATED TO THE PUBLIC.

Dr. George T. Moore, of the Weather Bureau, last year secured a patent on a method of making cultures of nitrogen-fixing bacteria and of drying them so that they may be sent all over the world, while at the same time their activity is indefinitely preserved. Nitrogen-fixing bacteria and their importance to agriculture have been discussed in these columns.

TRANSFORMER OUTFITS FOR THAWING PIPES.

The manifest superiority of electricity as a thermal agent in thawing frozen pipes, and the field for this service that awaits development, has attracted a considerable amount of attention on the part of central station managers, many of whom have improvised outfits for this purpose. There has arisen a very general demand for thawing outfits that shall have a range in capacity to cover all ordinary requirements; shall be portable, easy to connect, and moderate in price, and to meet this demand the Westinghouse Electric and Manufacturing Company has designed the two transformers herein described.

The larger of the two outfits, which is shown in the illustration, weighs complete, with transformer, switchboard, and base, 750 pounds. It occupies a floor space 2 feet 4 inches by 1 foot 10 inches, and is 1 foot 7 inches in height. A link in the top of the transformer case affords a means of lifting the outfit, and if desired, truck wheels may be attached to the wooden base. It will be seen that it is of small size and is very light in weight, giving it a superior portability.

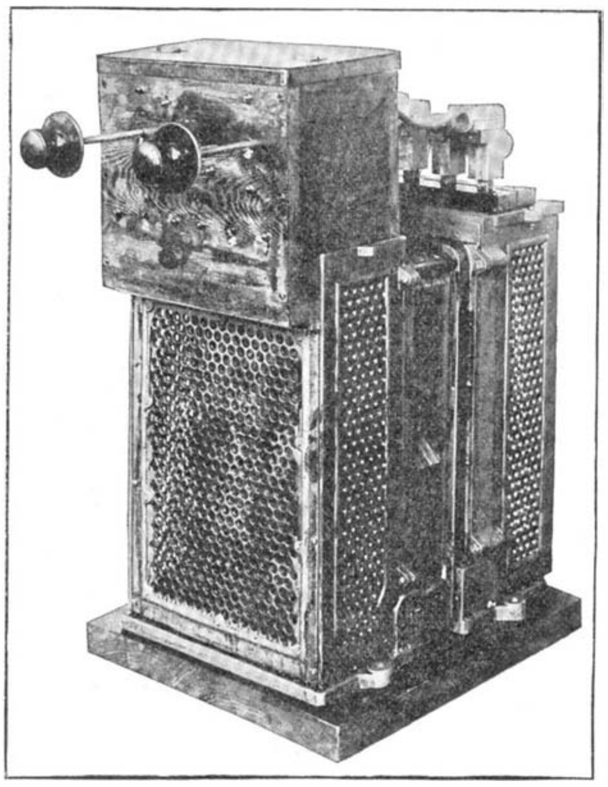
The transformer may be operated satisfactorily on circuits varying from 1,800 to 2,500 volts. The low tension is arranged to deliver approximately 500 amperes for several hours at an E. M. F. from 15 to 50 volts. By a simple change in connections, the windings may be arranged to deliver about 1,000 amperes at voltages from 8 to 16, for thawing large mains whose resistance is generally low. It is suitable for thawing anything from a one-half inch pipe to a one-foot main.

The transformer is generously designed, and will deliver large overloads for short periods of time. The windings are air-cooled. The insulation is not injured by rain, snow, or ordinary abrasion. There are no moving parts to get out of order, and the entire outfit is contained in a single unit.

A light but substantial switchboard is mounted upon the high-tension end of the transformer. The switches are of the inclosed-plug type, such as are used upon high-tension arc-light circuits, and permit a variation of the low-tension voltage and consequently the current supplied to the pipes. The switches are so arranged that it is impossible to make a wrong connection.

The smaller transformer outfit is particularly adapted for thawing service piping about dwelling houses. It is light, of such proportions as to make it easy to handle and is mounted in a wooden box provided with a handle and shoulder strap. It has a capacity of 200 amperes at potentials up to 25 volts for one hour. It is arranged for operation off a nominal 2,000-volt circuit, but can be supplied for any other primary voltage to as low as 200 volts. The voltage regulation and current control are obtained through plug switches in the high-tension circuit.

When desired, these outfits are furnished with a current-measuring device, so that the operator may know the amount of current that is being used.



TRANSFORMER FOR THAWING OUT FROZEN WATER PIPES.

A NEW TYPE OF LIFEBOAT.

The lifeboat "Uradd," which forms the subject of the accompanying illustrations, is of a type that certainly has strong claims to originality, and judging from her remarkable trip across the Atlantic, she may surely claim to be an extraordinarily safe craft. She left Alesund, Norway, on the seventh day of August last, bound for New York, and following a northern route she arrived at the Shetland Islands four days later. She left the Shetland Islands on the twentieth of August and arrived off Cape Spear, on the coast of Newfoundland, on November 16. Because of the stormy weather, however, she was unable to make port; but being observed by a passing fishing boat, she was piloted into Petty Harbor for the night, and on the next day she made St. Johns. This novel craft was designed by Capt. O. Brude, of Norway, specially to compete for a prize offered by the French government for the construction of a type of lifeboat which would reduce the loss of life in marine accidents to a minimum; and it must certainly be admitted that the successful test which she has undergone entitles her to a large measure of consideration.

This curious little craft, which may be roughly described as egg-shaped, is 18 feet in length over all and measures 8 feet on the keel. She is built entirely of steel, the frames being steel angles, and the skin being thin steel plating. She has been designed to accommodate as large a number of people as possible, and it is claimed that twenty persons can be made fairly comfortable, and that she is capable of carrying safely, in an emergency, as many as twenty-five. She is of four tons burden. On her trip she carried a crew of three men besides the captain, and they arrived after their long voyage in the best of health and spirits.

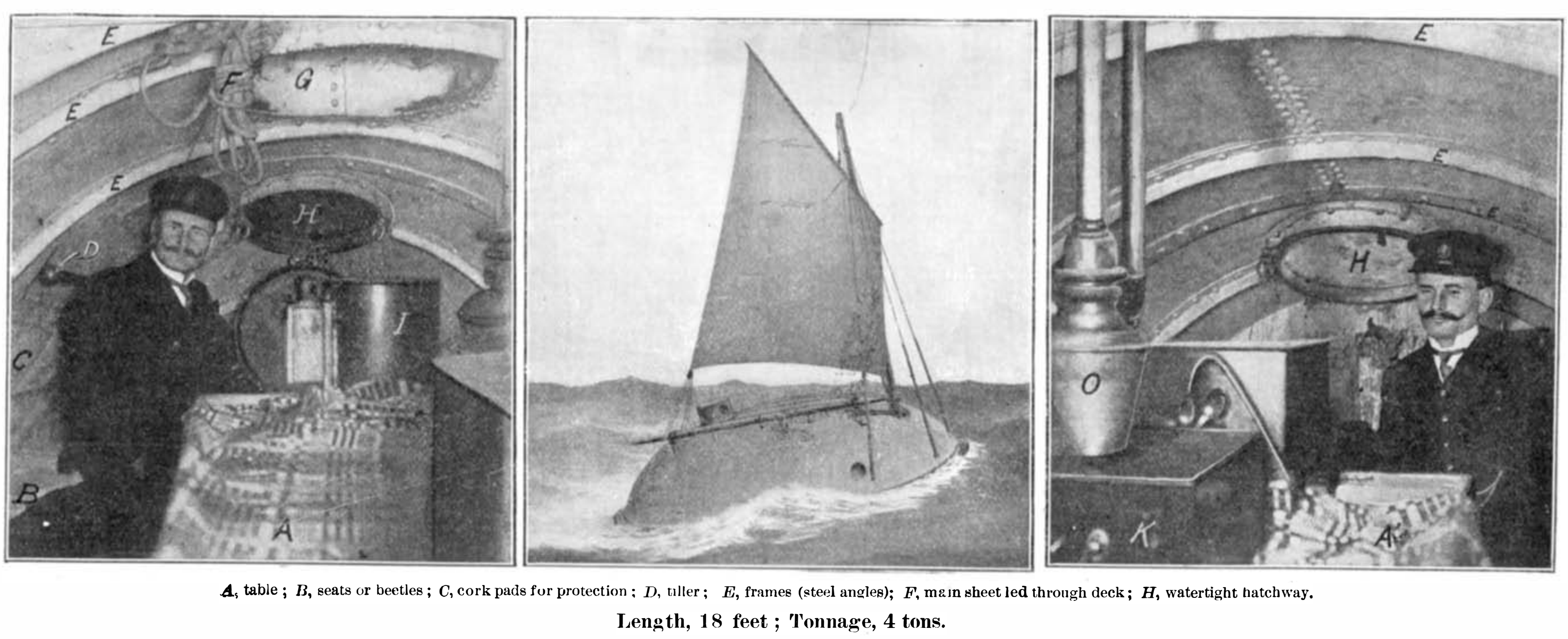
It will be seen from our engravings that the vessel carries a lug sail which can be operated from below decks, the halyards and sheets being led in through holes in the plating and coiled conveniently inside, as shown by letter *F* in the engraving. A couple of lifelines run fore and aft on the deck, and an anchor is secured forward near the stepping of the mast. Forward on either beam is a large porthole, and aft is a conning tower pierced with four water-tight portholes, through which a lookout may be kept in stormy weather. The interior of the craft is shown in the accompanying views. Down through the center extends a table *A*, and along the sides are seats, *B*, which may be used as sleeping berths, the seats being upholstered in morocco leather. Back of the seats against the side of the vessel are cork pads, *C*, for protection of the crew when the vessel is being tossed violently in heavy weather. The tiller, *D*, may be used either from the inside or outside of the vessel. The steersman stands with his head in the conning tower, *G*, and his hand on the tiller, and the sheets and halyards are led to convenient positions within the cabin. There is a watertight hatchway, *H*. The vessel is provided with a kerosene cooking stove, and that she is possessed of abundant storeroom is shown by her lengthy trip across the Atlantic Ocean.

Tree Planting on the Pennsylvania Railroad.

At the recent convention of the American Forestry Association, in Washington, D. C., Mr. Joseph T. Richards, chief engineer of maintenance of way of the Pennsylvania Railroad, gave an address on timber cultivation to supply railroads with ties, and the following statements are taken from press reports of that address. Seedlings, two or three years old, cost by the time they are planted, including labor, 8 cents each. They were planted 10 feet apart, averaging about 400 to the acre, although 54,871 trees planted recently were placed 6 feet apart and 88,127 were set 8 feet apart. The total number planted by the railroad company is as follows: Newton Hamilton, 13,610; Conewago, 68,460; Pomeroy, 20,280; west of Atglen, 16,537; Atglen, 8,108; Juniata Bridge, 20,730; Newport, 29,505; Vintage, 50,300; and along the Atglen and Susquehanna Branch, 53,000; a total of 280,530 trees. The land, except a tract of 14 acres at Newton Hamilton, is owned by the railroad company. To supply the increasing needs of Pennsylvania alone Mr. Richards estimates that it will be necessary to plant 1,300,000 trees each year for a period of thirty years, the time required for a tree to mature.

A New French Submarine.

The new French submarine "Korrigan" has recently made a remarkable performance. It remained submerged for twelve hours continuously from 6 A. M. to 6 P. M. without coming to the surface for an instant. During all this time the men did not suffer, and the apparatus on board worked very well. The "Korrigan" belongs to the submarine station of the Tunis naval division. It is coupled with the "Farfadet." Both these boats are of the "Lutin" type. The boats of this class have a displacement of 2.04 tons with a length of 41 meters (133 feet) and a width of 2.90 meters (9.7 feet). Motive power is supplied by a set of storage cells. One screw is used. The speed of these boats is 12.2 knots at the surface and 7 knots under water. Their radius of action at the surface is 80 miles at 12 knots, and 140 miles at 7 knots. Four torpedo-launching apparatus form the armament. The "Korrigan" was put in service in 1902, and made some interesting performances at La Rochelle, where it was stationed, under the command of Lieut. Delpeuch. Later on, the minister of the marine sent it to Tunis with the "Farfadet" to form the nucleus of the submarine station there. When the two boats made the voyage to the African coast they were taken in tow by a larger vessel, but the trip furnished some useful data as to this class of boats. The "Korrigan" is one of the best submarines of the fleet, and is handled with great ease. A few months ago, when piloted by Lieut. Delpeuch, it sank in the Mediterranean at some distance off Bizerta, and then navigating with the periscope it entered the port of Bizerta and sent a torpedo against the cruiser "Tempete," which lay at anchor. The plunge of 12 hours which the "Korrigan" has just made is the longest which has been as yet obtained in Europe, and shows the progress of construction which has now been reached.



A, table ; *B*, seats or beetles ; *C*, cork pads for protection ; *D*, tiller ; *E*, frames (steel angles); *F*, main sheet led through deck ; *H*, watertight hatchway.

Length, 18 feet ; Tonnage, 4 tons.

NAVIGABLE LIFEBOAT "URADD" WHICH CROSSED THE ATLANTIC IN THREE MONTHS.

ELECTRICAL RADIATORS.

BY EMILE GUARINI.

Electrical radiators are now so generally used for heating purposes that their great advantages over other methods are becoming well known. The following are the most prominent features in which they excel all other means of artificial heating: absolute cleanliness, absence of all fumes or smell, a pure intense heat, without combustion, and therefore without loss of oxygen from the air, heat obtainable immediately by turning on a switch, no loss of heat through flues or chimneys, ornamental design, portability, perfect regulation of temperature, safety from all fire risks. The electricity supply companies are now universally supplying current at reduced rates for heating, and in calculating the cost of working, consideration must be given to the saving of labor, and the decreased decorator's and painter's bill. For cases where it is impossible to obtain current at reasonably low rates, electrical radiators may still be used for auxiliary and temporary heating, and especially for bedrooms, bathrooms, etc., where the heat is required only for a short period.

We illustrate herewith several electric radiators of new design lately brought out by a London electric company. One of the patterns is particularly suitable for offices, etc., and in the better finishes, for private house heating. It is made with either three or four lamps, and two switches for regulating the temperature. The current consumption is 1,000 watts with four lamps and 790 with three lamps.

Another office pattern is suitable for similar purposes to the "Apollo" pattern. The standard finish is plain black stove enamel, and fitted with four lamps and two switches, the current consumption being 1,000 watts.

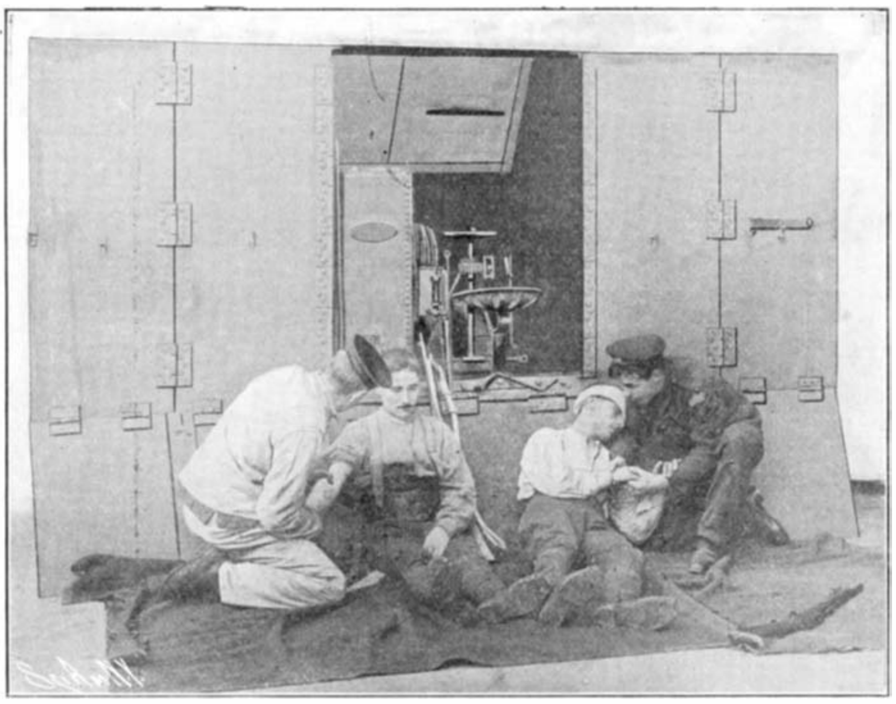
A third pattern is of very ornamental appearance and suitable for dining and drawing rooms, state cabins of steamers, etc. It consists of hammered iron base, highly lacquered hammered copper reflector, and is fitted with three lamps and two switches, the current consumption being 790 watts.

One interesting radiator is constructed throughout of polished brass and copper, with suitable reflector. It is finished in the best possible style, and fitted with four lamps and two flush switches, the current consumption being 1,000 watts. This pattern is particularly suitable for drawing and dining rooms, as is also the office pattern, which is of similar design and finish to the previous one. It is fitted with four lamps and two flush switches, and suitable reflector.

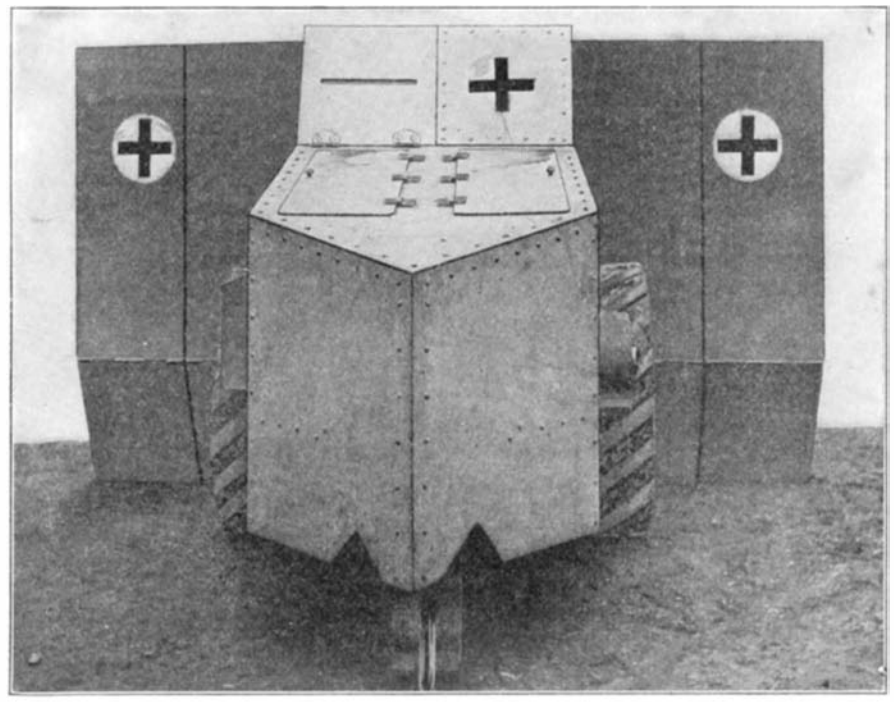
The "Pillar" pattern is especially suitable for halls, passages, shops, etc. This can be finished in art black stove enamel, colored stove enamel or vitro enamel in colors to suit the surroundings. The radiators are wired for various current consumptions to suit requirements, and fitted with two switches for regulating the temperature. The large size has a current consumption of 1,800 to 2,400 watts; the medium size, of 1,500 to 2,000 watts; and the small size, of 1,200 to 1,800 watts.

The small radiators are wired on the enamel system and are of the non-luminous type. They are most suitable for small offices and similar work, and are supplied in three sizes without switches or with two switches, the current consumption being 500, 800 and 1,200 watts respectively. The ornamental form is similar to the previous one, but mounted in handsome lacquered and polished cast brass framework for dining or drawing rooms.

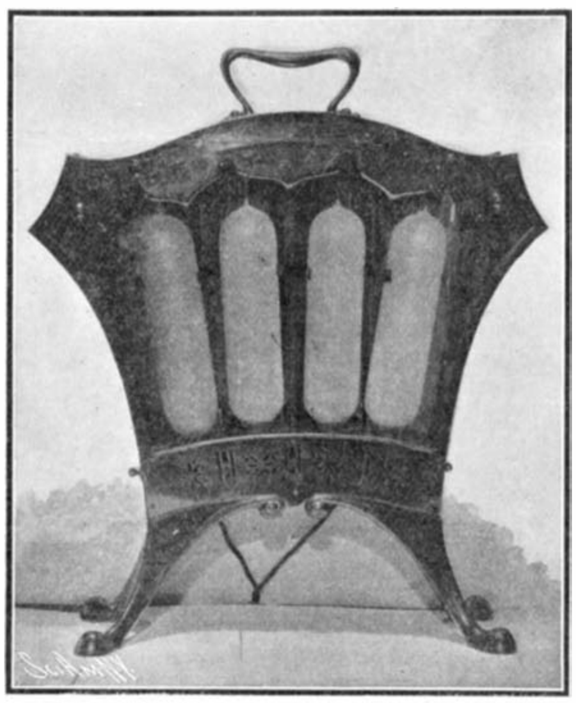
The heating lamps can instantly be fixed in the event of renewals. Their life is extremely long, and the heating effect well maintained throughout.



REAR VIEW OF AMBULANCE AUTOMOBILE.



FRONT VIEW OF THE AMBULANCE AUTOMOBILE.



Office Radiator: Current Consumption 790 to 1,000 Watts.

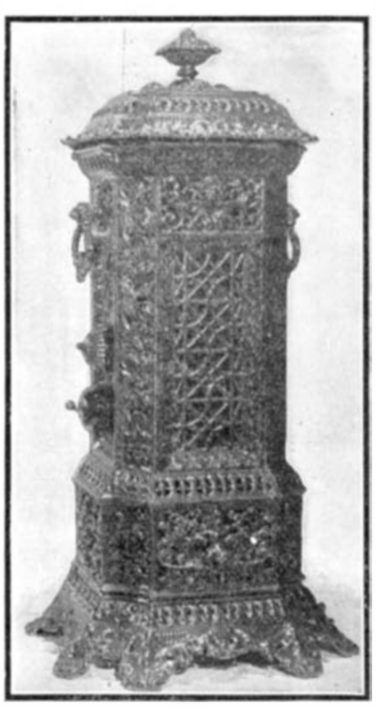
AN AMBULANCE AUTOMOBILE.

BY OUR ENGLISH CORRESPONDENT.

Further severe tests have been carried out in London with the Ivel armored Red Cross motor intended for service with the army medical staff at the firing line. The ingenious application of this motor was the idea of Major Palliser, of the Canadian militia. Trials under conditions similar to those existing in war were carried out a few weeks ago at Bisley, where a member of the American embassy in London was an interested spectator.

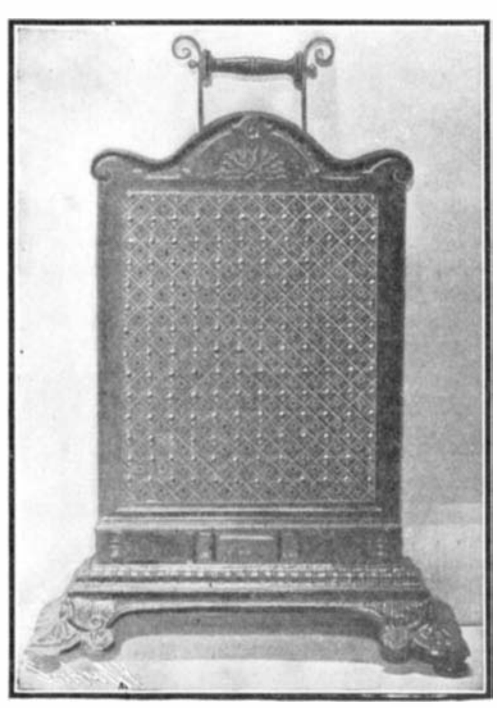
The Ivel motor employed for these operations is identically the same as that devised for agricultural work. It is a three-wheeled vehicle propelled by an 18-horsepower twin-cylinder gasoline motor. The tractor is of heavy construction, weighing complete about 30 hundredweight. The front or steering wheel is of small diameter, but the rear driving wheels are some four feet in diameter, stoutly constructed of steel and shod with wide iron tires, so as to insure a secure grip of the ground being attained.

For military ambulance work the motor is entirely incased in bullet-proof steel shields. The armor proofing consists of Cammell bullet-proof steel of one-quarter inch thickness. The back casing of the motor is so



Pillar Radiator: Consumption 1,800 to 2,400 Watts.

Office Radiator : Consumption 790 to 1,000 Watts.



Small Radiator: Consumption 500 to 1,200 Watts.

Pillar Radiator.

ELECTRICAL RADIATORS

constructed that flaps open outward on either side and on the ground, thereby protecting the ambulance staff while engaged in their work behind. The area thus protected is about 9 feet in width by 7 feet in height.

This first-aid vehicle, in the severe tests to which it was submitted, was driven over rough ground, and brought within close range of the firing line. The backways were opened out to cover the stretcher party at work behind. A severe fusillade was then poured upon the vehicle from rifles at ranges varying from 20 to 100 yards, but without penetrating the armor. Of course, the vehicle is not constructed with the object of resisting heavy gun fire, and a single shell from a large-caliber weapon would absolutely wreck it.

The car carries two ambulance men, one of whom also performs the offices of engineer and driver. The apparatus proved very serviceable and easy to handle upon the battlefield. Notwithstanding the rugged nature of the ground, a speed varying from three to six miles an hour was attained. Owing to its wedge-like shape, the bullets that struck it were deflected, without causing the slightest damage. One drawback which it possesses is that it can only be used with gasoline as fuel. As this volatile spirit is not easily procurable upon the battlefield, the engine is to be adapted to the consumption of cruder oils.

In addition to ambulance work pure and simple, it proved its efficiency for other phases of work in connection with first aid, by the haulage of the necessary auxiliary attachments for the sterilizing of water, etc. Also, while the work of tending the wounded was in progress, the engine, owing to its peculiar construction, was instantaneously detached from the driving gear, and by pulley and belting supplied the necessary energy for driving a portable ice-making plant designed for service in tropical climate. When the tests in the firing line were completed, the ambulance car returned to safety, hauling a supplementary ambulance wagon containing thirty wounded men—a task which was easily accomplished, owing to the great power of the motor.

As this was a first attempt to prove the efficiency and utility of such an automobile for this class of work, several defects presented themselves. These, however, were of an easily surmountable nature, and have been since remedied. The car, however, established complete success, and is to be submitted to further trials. Another important advantage it provides is that owing to the arrangement for disengaging the motor and driving mechanism, the car can be utilized as a stationary engine for generating electricity for illuminating the hospital tent in camp, or other purposes for which power is required.

ELECTRICAL EQUIPMENT OF THE NEW YORK CENTRAL RAILROAD.

Judged from the standpoint of its magnitude and the far-reaching results which must follow, the electrical equipment of the New York Central system, which is now under way, is the most important event that has happened in the application of electrical traction to steam railroads. It is true that the electrical equipment of limited sections of steam railroads is nothing new; as witness the work done on various roads both here and in England—to say nothing of the Valtellina electric line in Italy; but the novelty of the New York Central work lies in the great magnitude upon which it is being carried out; the elaborate and carefully systematized experimental work now being done near Schenectady; and the important bearing which all of this will have upon the great question of the electric operation of long-distance railroads between such points as New York and Chicago, or New York and Pittsburg, or Washington. There is no body of men in the world that is so extremely practical or so reasonably conservative as your railroad engineer; and the fact that the New York Central engineers, whether in the department of civil, electrical, or steam engineering, are willing to admit that the ultimate outcome of the present work that is being done at the New York terminus, and on the suburban lines of the New York Central system, will, quite possibly, lead to the ultimate application of electric traction to the whole of their fourteen thousand miles of track, may be taken by laymen in general as a pretty sure guarantee that this stupendous change will actually be made within the present decade.

The changes involved in this work include the electrifying of the New York terminal for a distance of 34 miles on the main line from the Grand Central station, and for 24 miles on the Harlem Division as far as White Plains. The express service will be separated from the local service, the express trains being hauled as far as the points named by electric locomotives, and the local trains being operated on the multiple-control system as used on the Elevated and Subway lines. This separation of the service will involve the four-tracking of these roads, and indeed on some portions there will be as many as eight tracks. The express trains will be run on the regular schedule demanded by the company's through express service to distant points; but the suburban service will be vastly improved by shortening the trains and running them at more frequent intervals, the proposed schedule calling for a train every two minutes. The well-known ability of the electric motor to start a train rapidly and quickly carry it to full speed will result in a great acceleration in the average speed of this local service; and there can be no doubt that the increased frequency, higher speed, and general all-round convenience of the new service will result in a great upbuilding of the most distant suburban districts. Two years from the present time will probably see the electrical service in full swing, although there may be some finishing work to be done in the terminal station and yards. In rebuilding the line, the platforms are to be raised to the level of the floor of the cars, all grade crossings are to be eliminated, and much of the heavy curvature of the line is to be reduced or cut out entirely.

The scheme for hauling the heaviest express trains by electric locomotives is an entirely new one. There is absolutely no precedent to go upon. It was for this reason that the New York Central determined to equip a section of their main line with apparatus that should correspond to that with which the suburban lines are to be equipped. For this purpose a stretch of six miles of the east-bound local tracks of the New York Central was selected, a few miles beyond the city of Schenectady, and this has been equipped with the standard third-rail construction. The track is practically straight and is ballasted so as to permit of a maximum speed of 70 to 80 miles per hour being obtained. Power is furnished by a 2,000-kilowatt, three-phase, 25-cycle, Curtis turbo-generator, delivering 11,000 volts to the line. The generator is located in the new power house of the General Electric Company at Schenectady. The current is carried by a high-tension transmission line to a sub-station at Wyatts located at the center of the six-mile stretch of track. Here the 11,000-volt, alternating current is stepped down and converted to 600-volt direct current, at which pressure it is delivered to the third rail, from which it is taken by the contact shoes of the locomotive.

For the past three months an experimental electric locomotive has been hauling trains of various weights over this track, and careful records have been made of the results obtained under widely different conditions of load, and under every possible condition of the weather. The locomotive is one of fifty which will be used in hauling express trains, the heaviest of which will reach 875 tons in weight. The maximum speed contemplated is from 60 to 65 miles per hour. By using the multiple-unit system of control, two or more locomotives can be coupled together and operated from the leading cab as a single unit. A single electric locomotive will be able to maintain the schedule with a 450-ton train, and two locomotives will be coupled together for the heavier train.

The locomotive is carried on four driving axles and two radial pony trucks. On each driving axle is mounted, without intermediate gearing, the armature of an electric motor having a normal rating of 550 horse-power. The normal rated capacity of the locomotive is 2,200 horse-power, although at starting it can develop 3,000 horse-power or more. An interesting feature is that in the new locomotive the armature is mounted rigidly upon the axle, thus reducing the bearings to those of the pony trucks and the main journals, all of which are outside of the driving wheels. The motor has two poles, whose faces are flat and vertical, to permit a large vertical movement between armature and poles as the latter move up and down with the riding of the frames upon the springs. The main frame is of cast steel. The pole pieces are carried by heavy steel transoms, bolted to the side frames, which form part of the magnetic circuit, besides acting as cross braces for the truck. This construction, besides being strong and simple in design, greatly facilitates repairs and renewals, as an armature with its wheels and axle may be removed by lowering the complete element, without disturbing the wheels or any other part of the locomotive, and a new element inserted in its place. In addition to the four pairs of driving wheels, there is a pony truck of the radial type at each end of the locomotive.

In spite of the fact that the armatures are attached rigidly to the axles, the dead weight on the axle is not materially greater than is customary with steam locomotives; and in addition, there is no unbalanced weight to produce the hammer blow of the steam locomotive, which has proved so disastrous to track and roadbed. The superstructure consists of a central cab for the operator, containing master controllers, engineer's valves, and the necessary switches and valves for operating, sanding, whistling, and bell-ringing devices. This apparatus is furnished in duplicate, one set on each side of the cab, and it is arranged so as to conform in a general way to the position of the similar controls in the cab of a steam locomotive. The operator has an unobstructed view both in front and rear from the windows of the cab. A central corridor, extending through the cab, is provided with end doors through which there is access from the locomotive to the train. On each side of this corridor are arranged the contactors, rheostats, and reversers. They are carried in boxes of sheet steel, and are sheathed on the inside with fireproof insulating material. The control system permits of three running connections, namely, four motors in series, two groups of two in parallel series, and all four motors in parallel.

The accompanying comparative table of one of the new electric locomotives and the new compound steam locomotive recently designed for the same service will be of great interest. The compound, which was exhibited at St. Louis, was illustrated in our issue of July 30, 1904, and reference is made to that article for illustrations and full particulars of this fine engine. This engine is the latest and most powerful express locomotive on this road, exceeding the celebrated Atlantic type of simple engines that are used at present in handling the express service. In this engine we see the limit of size, weight, and power to which an express steam engine can be carried; and yet it will be seen that on every point of comparison, the electric locomotive is more efficient. The new type is 25 feet

COMPARISON OF N. Y. C. R.R. ELECTRIC AND STEAM LOCOMOTIVES.

	Electric	Steam
Total length	37 feet	62 feet, 2¾ inches*
Total weight	95 tons	162 tons*
Weight on drivers	69 tons	55 tons
Maximum horse-power	3,000	1,800
Horse-power per ton weight	31.5	11.1

* Including tender.

shorter; weighs 67 tons less; has 14 tons more adhesive weight, and has 10¼ tons less weight concentrated on each pair of wheels, and is therefore proportionately easy on the track; has 1,200 more horse-power available for starting a train; and indeed on a basis of horse-power per ton weight of locomotive is 300 per cent more efficient. The total absence of reciprocating parts renders the electric locomotive even easier on the track than the balanced compound steam locomotive.

The tests already made indicate what may be expected of a locomotive running in regular service. With an eight-car train weighing 336 tons, exclusive of locomotive, a maximum speed of 63 miles per hour was reached, and 72 miles per hour with a four-car train weighing 170 tons.

In the starting tests a speed of 30 miles per hour was reached in 60 seconds with an eight-car train weighing, including the locomotive, 431 tons, corresponding to an acceleration of one-half mile per hour per second. During certain periods of the acceleration the increase in speed amounted to 0.6 mile per hour per second, calling for a tractive effort of approximately 27,000 pounds developed at the rim of the locomotive drivers. This value was somewhat exceeded with the four-car train, where a momentary input of 4,200 amperes developed a tractive effort of 31,000 pounds at the drivers, with a coefficient of traction of 22.5 per cent of weight on drivers. The average rate of acceleration with the four-car trains, weighing including the locomotive 265 tons, was 30 miles in 37½ seconds, or 0.8 mile per hour per second, calling for an average tractive effort of 22,000 pounds.

The maximum input recorded, 4,200 amperes at 460 volts, or 1,935 kilowatts, gives an output of the motors of 2,200 horse-power available at the wheel. With 4,200 amperes and a maintained potential of 600 volts there would have been an input of the locomotive of 2,520 kilowatts, corresponding to 2,870 horse-power output of the motors. This output is secured without in any way exceeding the safe commutation limit of the motors and with a coefficient of traction of only 22.5 per cent of the weight on the drivers, thus placing this electric locomotive in advance of any steam locomotive yet built. No service capacity temperature runs have been made as yet, and the preliminary tests have not shown any appreciable warming of the motors sufficiently to take thermometer readings.

Throughout both the starting and running tests the electric locomotive shows its remarkable steadiness in running, a distinct contrast in this respect to the steam locomotive, especially should the latter be forced to perform the work here shown to be accomplished by the electric locomotive.

The elimination of gear and bearing losses permits of a very high efficiency of the locomotive. Reference to the motor characteristics shows a maximum efficiency of approximately 93 per cent, this value being fully 4 per cent better than is possible with motors of the geared type. This gain is especially noticeable at the high speeds, the efficiency curve remaining above 90 per cent even at the free running speed of the locomotive alone, in contrast to the 85 per cent or less which would be a good showing for a locomotive provided with geared motors. The simple construction and high efficiency made possible with this design of gearless motor, together with the minimum cost of repairs attending such a construction, makes the direct-current gearless-motor type of locomotive a distinct forward step in electric-locomotive construction.

Correspondence.

The Seedless Apple's Past.

To the Editor of the SCIENTIFIC AMERICAN:

Your paper of the 4th instant, in describing the new seedless apple, says that its origin is quite recent.

Over thirty years ago seedless apples were produced near Phillipsburg, N. J., and, by the same token, hogs were raised there with solid hoofs.

Now the apple has disappeared from there and the hog of the solid hoof is found in Kansas, and at Winsted, Conn., in possession of Mr. Burton E. Moore.

Ossining, N. Y., February 5, 1905. H.

Panama Canal.

To the Editor of the SCIENTIFIC AMERICAN:

In reading the abstract of the engineers' report in your issue of the 31st ultimo, the following idea has occurred to me. Would it not be possible to construct two parallel tunnels, each say 100 feet in diameter, at sea level—50 feet above and 50 feet under—through a suitable route where there would be the least obstruction from rock?

A proposition of the same nature was made some fifteen years ago by the Messrs. Stevenson, of Edinburgh, in their proposal for a ship canal between the Forth and Clyde *via* Loch Lomond. The length of the tunneling in this case would be only two miles and through rock, but in the case of the Panama Canal it would probably be desirable to avoid that.

The difficulty through the alluvium could probably be got over by lining with iron as fast as constructed this method being now well understood on a small scale from the construction of underground railway "tubes," now so common. JOHN STRUTHERS.

7 Portsdown Road, London, January 17, 1905.

[The Canal Commission decided that a tunnel canal was impracticable in a region that was liable to seismic disturbances.—ED.]

The Changing Color of Glass.

To the Editor of the SCIENTIFIC AMERICAN:

Some time ago there appeared in your columns a communication concerning the change in color of common clear glass if left exposed in certain desert regions of the earth. Your correspondent, as he described the phenomenon, explained it as being caused by the alkaline substances in the soils where the glass happened to be lying.

I have observed this discoloration in glass for several years in the course of many trips over the Western deserts as an engineer and surveyor. I cannot think it is because of alkaline influence. I believe it due almost entirely to the great activity of the actinic rays from the sun in those regions where, owing to the extreme transparency of the atmosphere and its freedom from dust and moisture, their effect is much more noticeable.

It is not necessary, for this discoloration to occur, that the glass—bottles, flasks, broken tumblers, or any clear glass—be lying on the ground. I have repeatedly noticed it when the glass was on shelves, porch roofs, and even hung several feet above the ground by a string. It seems probable that it is due to some complex chemical reaction, where the very small quantity of iron—generally a low oxide or other chemical form—is changed to some of the higher oxides, imparting a clear, rich, amethyst or rose-purple color, the intensity varying with the time of exposure.

An ordinary piece of table glass, or the flat flask so often seen in mining and desert towns, will almost equal the color of standard amethyst after six months exposure in summer, while a fortnight is sufficient in most cases to produce a distinct tint. If kept in the shade the same effect is noticeable, but requires a much longer time. I have observed the same phenomenon in localities of Southern California where climatic conditions are similar, but little or no alkali present in the soil. WILL L. BROWN,
Principal of High School.

San Bernardino, Cal., February 1, 1905.

A Protest Against the Meter and an Appeal for the Yard.

To the Editor of the SCIENTIFIC AMERICAN:

Sixty years ago you commenced writing articles in your journal in favor of introducing the metric system into the country, but every succeeding day has only placed that system, for us, further and further away.

Why? you ask. Well, just consider. Our little Essex County Registry of Deeds in 1840 contained 360 record books, about 8 x 12 inches in size, of 500 pages each, written closely on both sides. To-day we have over 1,900 books filled with deeds and other legal instruments, all written in our measures, rods and links, or rods and feet, or feet and inches. Now multiply by all the counties in the United States and the island of Great Britain, and then remember that somebody must be able to read anyone of all these deeds for all time to come.

But this is not all, by any means. We buy and sell more of the world's goods, agricultural and manufactured, in the United States than in all the other countries of the world combined; that is, our home market is worth more than all the other markets put together; and all these transactions are in our present heterogeneous measures, but no power on earth can change them.

You remember the effort of the Chicago Board of Trade to substitute the cental for the bushel, and the result. Grain is still bought and sold by the bushel and likely to be.

Now please allow me to suggest that there is one way, and only one, to get a *universal standard* of weights and measures. Let all the countries that use the metric system change the meter to our standard yard.

The metric nomenclature would not be changed at all, only a slight change in the quantities, but with our standard yard for the meter, the two systems could be reduced, each to the other, without that intermediate decimal.

I make this suggestion for your consideration.

Haverhill, Mass., January 16. N. SPOFFONE.

Photography of the Eye.

To the Editor of the SCIENTIFIC AMERICAN:

My attention has been called to an article in your issue of December 17 on "Photography of the Interior of the Eye." In that is described the method which was adopted by Dr. Thorner, and illustrations are given of the results obtained. As the subject is deemed worthy of much space, it may possibly be interesting to know that very much better results than those were obtained nearly twenty years ago, in this country, and by a much simpler process. The description of this was given in a communication by me to the American Ophthalmological Society in 1887, and was published in the Transactions of the Society of that year, the photographs being shown at the same time.

Of the many attempts which have been made to photograph the interior of the human eye, these results were generally considered the best until surpassed by those of Prof. Dimmer, of Gratz. Last September, at the meeting of the International Ophthalmological Congress at Lucerne, I had the pleasure of examining the apparatus used by him and the picture which he obtained. The apparatus used is as large as a small piano, and almost as complicated, the cost being so great as practically to preclude its use as a clinical instrument.

Two principal difficulties in this problem are to do away with the reflection from the cornea and to obtain a plate sufficiently sensitive to the red rays reflected from the living retina. I would be glad to co-operate with others who might also be interested in the subject; and if a satisfactory photograph can be obtained by a process so simple as to make it of practical value, it would be creditable to the one who succeeds, and certainly would assist in advancing our knowledge of the interior of the eye and its various diseases.

DR. LUCIEN HOWE.

Buffalo, N. Y., December 21, 1904.

Passe-Partout Framing.

BY CHARLES E. FAIRMAN.

The rapidly increasing number of beautiful prints of various kinds, which in themselves are inexpensive, but of such an artistic quality, that if properly framed form a valuable help to the decorating of the study or den, often causes the owner to wish that framing was less expensive, and that some method could be devised which would permit of the use of these art objects upon the walls in some more attractive and permanent manner, than by fastening with pins or thumb tacks. This can easily be accomplished by the means of the passe-partout, a method which is at the same time not only inexpensive, but serves to give the print a finished appearance, and preserves it fully as satisfactorily as if framed expensively.

In order to make passe-partout frames properly a board should be prepared as follows. Select a smooth board without warp two or three inches longer and wider than the largest frame desired. Finish the two longer sides by nailing on the edge a narrow strip which should project above the working side of the board not more than 1-16 of an inch. This will be found sufficient to prevent the glass used from slipping off the board, and will provide a resting shoulder against which the glass may be pressed during the making of the frame. On one side of the board draw a line at a distance of ½ inch from the projecting edge; at the other side of the board a line should be drawn ½ inch from the opposite projecting edge. These lines should be marked plainly and accurately, as they form the guide lines upon which the binding strips are placed, and if they vary in distance the binding strips cannot be accurately placed in position.

The binding strips should be selected from some strong paper or gummed binding cloth that will either harmonize with the print to be framed, or with the paper which may be used as a mat to give the print a sufficient margin. For this purpose I use the lighter grades of cover papers which are cut into strips by the use of the common yard-stick and a very sharp knife. It will be understood that the placing of a smooth sheet of binder's board underneath the cover paper will render the cutting of the binding strips much easier. The strips should be two inches wide if a large size frame (11 x 14) is to be made; for smaller sizes a narrower strip may be used, but the wide strip is much easier to handle and gives added strength to the frame.

For backing the ordinary straw board is all that is required. This can often be found among the waste paste-board boxes in the home. In fact, parts of old boxes are preferable to new stock bought at the paper warehouse for the reason that new stock is rarely thoroughly dried, and I have known instances where the drying of the backing board has caused such a warping tendency that the cover glass has been broken. The backing boards should be cut to the exact size of the glass which is to be used in framing. Any deviation in the measurement of the glass and the backing board will result in an unsightly frame that the most skillful worker cannot avoid.

The hangers for the frame can usually be secured at stores where picture frames are made. If these are not procurable the small brass rings can be purchased at hardware stores, and narrow strips of tin can be used to form the loops on which the rings are fashioned. These strips should be fully two inches in length and should be threaded through the rings, then doubled so that the ring will hang midway between the ends, which are passed through narrow slits in the backing board, and then spread in the manner of a paper fastener and hammered down until they are perfectly flat. To make the frame proceed as follows: Place the glass upon the board so that it will be in perfect register with the projecting edge. The binding strips should have been previously moistened and the surplus water blotted off. With a bristle brush apply Higgins paste or some similar mountant to one of the binding strips and work the paste in thoroughly, so that the strip will be well saturated with the paste so well worked in that it will not ooze out upon the glass. This precaution will not be necessary if a prepared gummed strip is used. The binding strip which should be of the exact length of the side of the glass to be covered should now be laid upon the glass, using the line described above as a guide. Press the strip gently with the fingers until partial adhesion results, and then rub in perfect contact with a soft cloth. The glass should be then turned and the opposite side covered in the same manner.

In binding the last two sides tiny strips of paper should be placed on the edges of the binding strips already in position so that the paste from the remaining strips will not soil the corners which are to be mitered. In finishing the last sides the outer strips should be mitered by the use of a miter pattern made from a thin piece of wood or cardboard. This pattern is laid upon the binding strips after they are firmly placed in position and the outer strip cut with a very sharp knife. The corners, with the underlying protecting paper, can then be removed and the last binding strips rubbed into thorough contact.

The cover glass is now ready for the final binding with the print and the backing board. The glass should be removed from the board, and a clean paper spread upon the board upon which the glass is placed face downward. Upon this lay the print with its mat—if any—face downward, place upon this the backing board, taking care that the hangers are in the right position or the framed print may be found, when finished, to be arranged for hanging in a reversed position. Great care should be taken to see that the print, the mat, and the backing board are in accurate register. Paste should then be liberally applied to the projecting edge of the binding strip on the right-hand side, and when thoroughly pliable the strip should be closely drawn over the edges of the frame, onto the back of the backing board, and then rubbed in contact with the soft cloth. The frame should then be turned so that the left-hand side occupies the place of the right side now completed, and this side and the ends treated in the same manner.

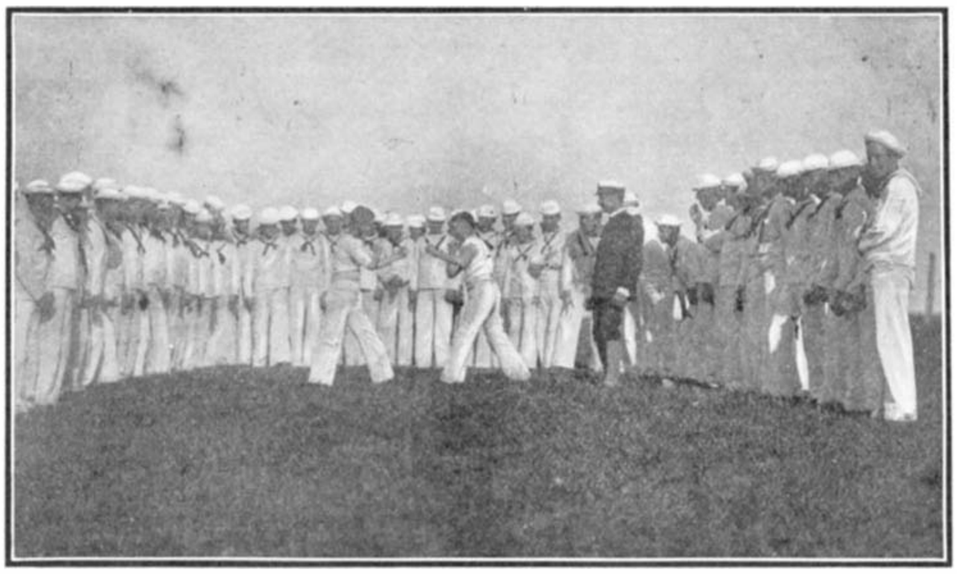
To make passe-partout frames so perfectly that they will have the appearance of frames made by the professional frame maker requires only ordinary mechanical ability, and the care which is required in doing even the simplest things well. If the instructions given are carefully followed, it will be found that choice prints, book covers and posters can be made into attractive ornaments for the home at a minimum cost, with the added satisfaction that the work has about it that personal quality and interest which is never felt when the work has been done by others.

THE UNITED STATES NAVAL TRAINING SCHOOL AT NEWPORT.

BY WALTER L. BEASLEY.

What is considered one of the most important and vital branches of the naval establishment is the training of the newly recruited apprentices destined to render future service on board our battleships, cruisers, and other types of armored vessels. At present there is a great scarcity of enlisted men in the navy, so much so that three or more warships have just been ordered out of actual service, so as to supply crews to man the new ships completed and awaiting commission. According to recent naval estimates, it is stated that when all the ships now building are put into active service, it will take about 2,000 officers and over 60,000 enlisted men to man them, which is more than twice as many as the present law provides for. To meet the demands of the growing navy, the training schools are unusually active at present, and are now taxed to their fullest capacity. Besides the present training squadron, two 800-ton cruising and sailing ships recently launched, accommodating in the neighborhood of 250 apprentices, and the new barrack building at the Newport station, nearly ready for occupancy, where 1,000 boys can be quartered, will add additional facilities to the training system. The government has two nautical schools, one at San Francisco and the other at Newport. The latter station is the most commodious, and to it the great majority of the enlisted youths from the East and Middle West find their way.

The Newport station, which is in charge of Commandant Thomas, is located on Coaster's Island, and is one of the largest and finest in the world. Its picturesque setting, high, spacious parade grounds, and groups of imposing structures, offer upon first sight a welcome and favorable impression to the incoming apprentice. The great main barracks, his future home, is hid from view at the regular landing-place, and lies at the foot of the hill beyond, on the west shore.

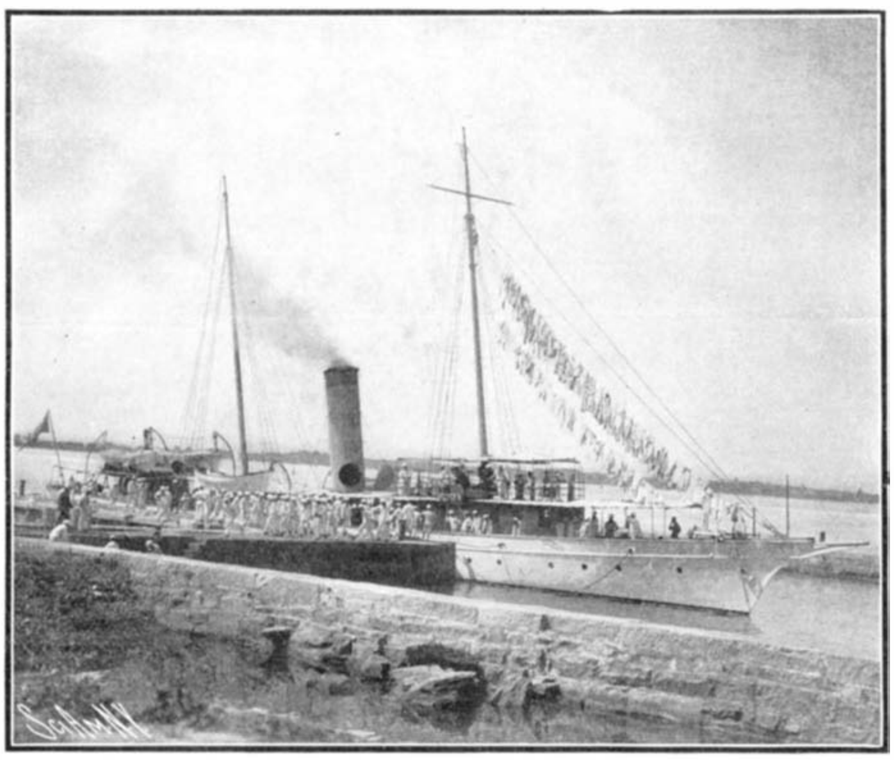


A Boxing Match.

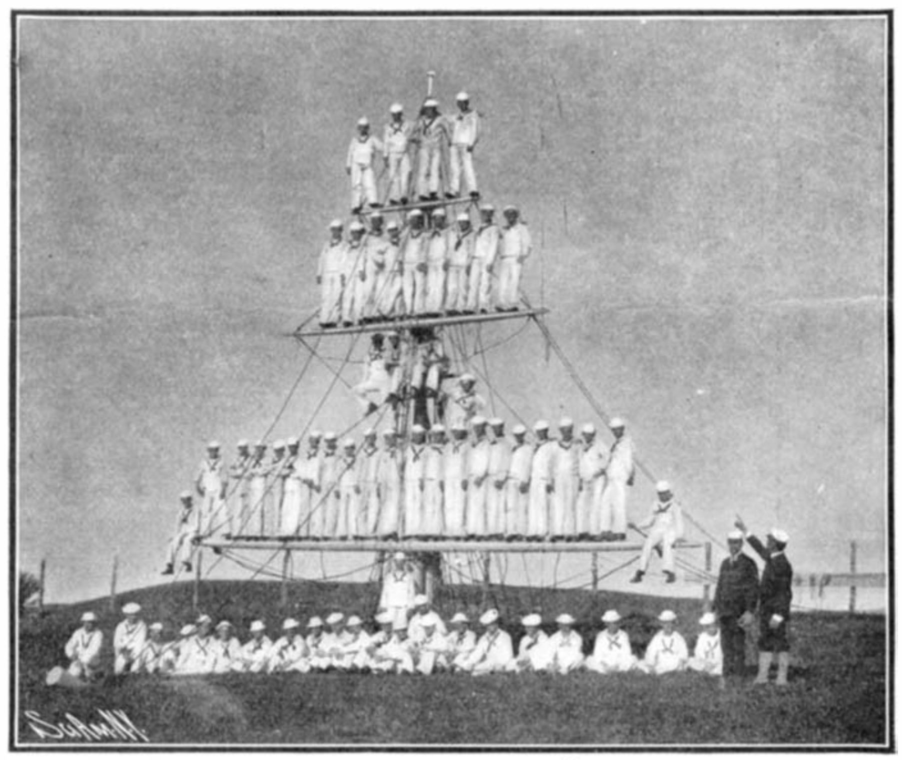
The apprentices are brought in squads and come separately from rural farming communities, small villages, and towns and cities from the West, North, South and East, as well as from recruiting vessels that ply along the New England and adjacent coasts. At the training school for six months the navy puts the young sailor lads through a course of preliminary training necessary to fit them for their first cruise at sea. Here are the first requirements at the outset of their career. The apprentice must be of American birth, seventeen years of age, and he is required to enlist for four years, after showing credentials of consent from his parents or guardians. Boys who have been convicted of crime or who are known to be of bad character are not permitted to enlist. Each boy is supposed to spend twenty-four hours in the detention building, when he is pronounced free from disease germs. He is transferred to the "newcomers' squad" and quartered for the next three weeks in the old gymnasium building, with large mess hall, drying-room on the first floor, and dormitory upstairs.

Here they are taught a few rudiments—first cleanliness and then discipline. They are kept under close observation all the time while in this building and are taught how to keep their clothes clean, to scrub and dry their apparel, to sling and get into a hammock, to lay out their kit for inspection, salute and fall in, and all the preliminary instruction necessary to qualify them for the battalion in the shortest time. When they are proficient in these things and are shown to have no disease germs, they are assigned to the battalion in the main barracks, where their real instruction begins. The battalion is divided into four divisions, and for the purposes of instruction the apprentices are

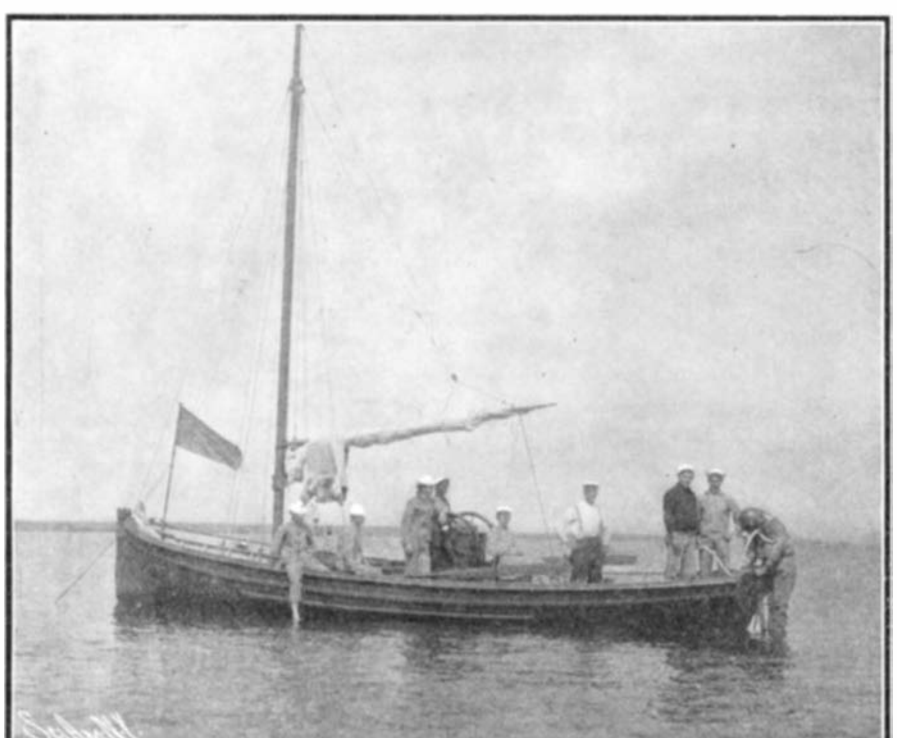
(*Continued on page* 146.)



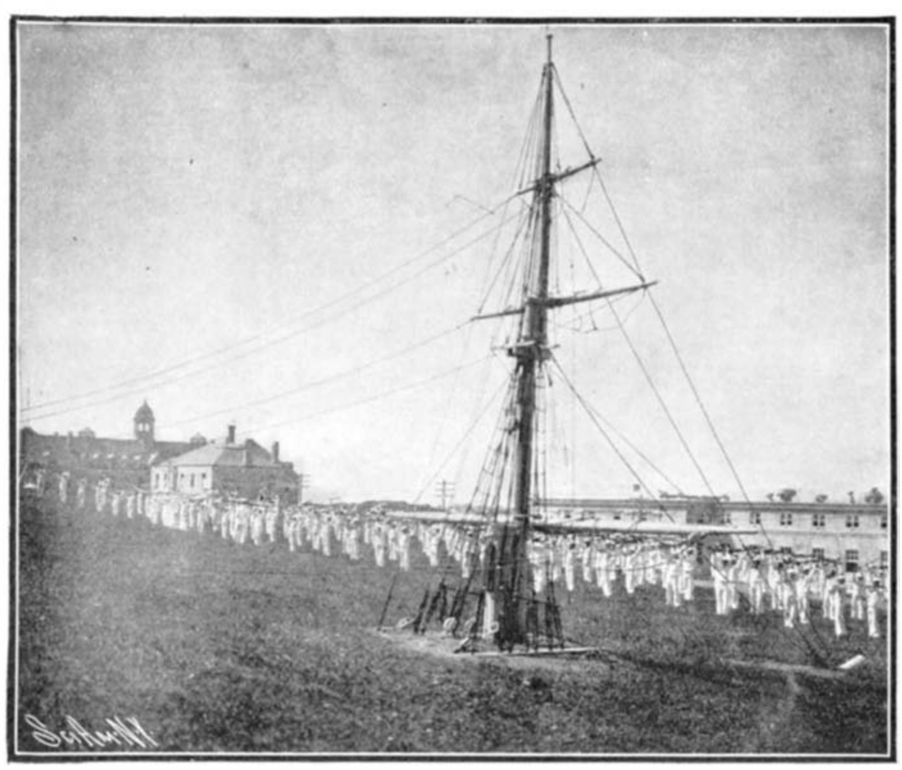
The "Hist" Boys Off for a Cruise.



A Drill on the Land Mast.



The Diving Class.



The Music and Physical Drill.

THE UNITED STATES NAVAL TRAINING SCHOOL AT NEWPORT.

THE ORIGIN AND FORM OF HOARFROST.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

At a recent meeting of the British Association for the Advancement of Science a series of interesting photos was exhibited by Dr. Karl Grossmann, F.R.C.S.E., F.G.S., and Mr. J. Lomas, A.R.C.S., F.G.S., demonstrating in detail the origin and formation of hoarfrost crystals. As is well known, the production of hoarfrost is attributable to the transition of aqueous vapor directly into the solid state, and so quickly is the metamorphosis effected that there is no apparent intervention of the liquid state between the two extremes of vapor and solid.

These two scientists have considerably extended the environment of our knowledge of hoarfrost crystals, and their present results represent some eleven years of patient investigation into the phenomenon. It first excited Dr. Grossmann's attention in the ice cave in Iceland. This particular cavern penetrates a mass of lava. In the course of time, the water deposited upon the external surface of the cave has percolated through the interstices of the rock and penetrated to the interior. The result is the formation of a number of beautiful ice cones.

In the photograph accompanying this article, which was secured by means of magnesium flash-light, some idea of the beauty of these formations may be gathered. They are perfectly transparent, being of a light bluish tinge. The transition in the cave has indubitably been direct from aqueous vapor into the solid state.

The walls of this cavern were coated with some remarkably fine hoarfrost crystals, and upon minute examination they were discovered to be of a shape not previously known.

It is well known that crystals vary in their shape of formation according to their nature. That is to say, frost is of one type, salt is of another, potassium chloride another, and so on. In 1867 Knop, in his work on the molecular constitution and growth of crystals, published at Leipzic in 1867, demonstrated the difference in the formation of the rock-salt crystals and the potassium chloride crystals (see diagrams 2 and 3). Each of these crystals originates in a cube, but the successive development is somewhat dissimilar. In the former, upon the fundamental cube, is superimposed a thin rectangular disk with a cube at each corner, another disk upon this, and so on, each successive step being somewhat larger than the previous one, so that a pyramid is thus formed, with the external faces complete and the central portions incomplete. In the case of the potassium chloride crystals, they are built up of successive cubes also in the form of steps. The construction of hoarfrost is analogous to that of salt crystals to a very great degree. In this instance the definite construction they assume is that of hexagonal hollow pyramids. But until the investigations of Dr. Grossmann, the form of construction and successive development was only incompletely known. The only previous scientist who had devoted his study to this subject concluded from his researches that the crystal was attached by one of its corners, and expanded therefrom. Dr. Grossmann has demonstrated this contention to be fallacious, for in no single instance has he found the crystals forming in any but one particular manner, with but slight variations, and the latter upon examination were attributable to adverse influences.

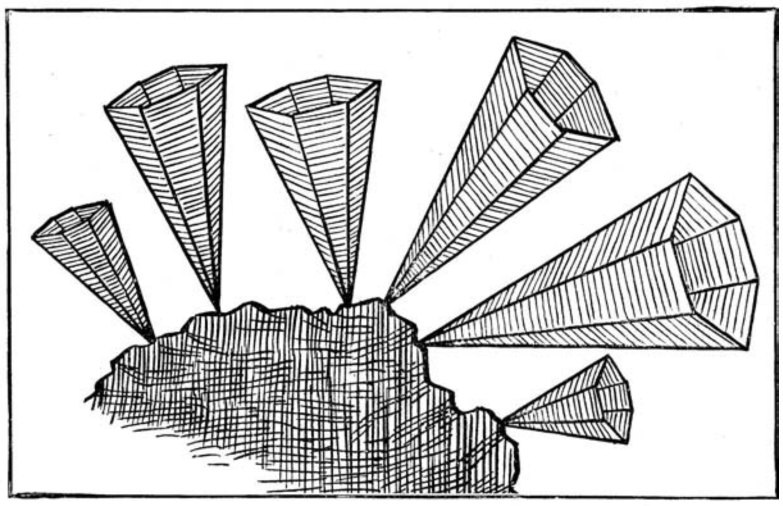


Fig. 1.—The Hollow Hexagonal Pyramids Springing from the Base.

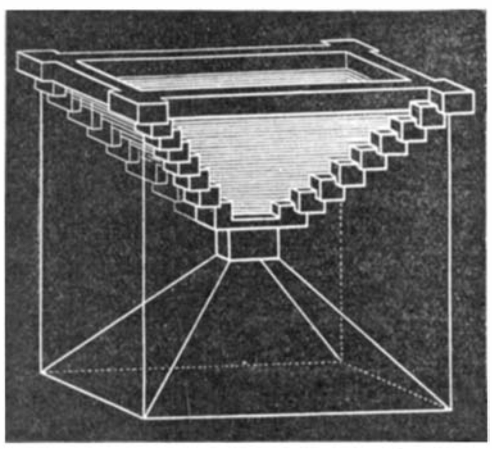


Fig. 2.—Skeleton Crystal of Sodium Chloride.

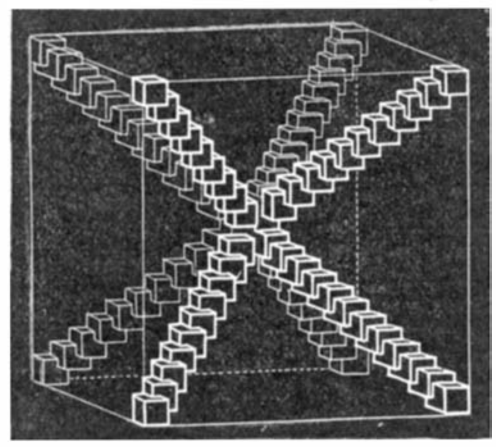


Fig. 3.—Skeleton Crystal of Potassium Chloride.

In the ice cave of Iceland Dr. Grossmann discovered that these hexagonal hollow pyramid crystals were very definitely formed. This was entirely due to the absence of extraneous atmospheric influences, for on the whole the air within the cave was comparatively quiescent. At those places where currents of air existed, or other influences were at work, the frost crystals assumed different shapes due to parts being broken or corroded, but in these particular cases it was also discovered that the crystal was built upon a hexagonal foundation.

From his investigations in the cave and his subsequent experiments, Dr. Grossmann discovered that the most favorable conditions for the production and development of large crystals were a moist air, at a low temperature, and the presence of a quiet, undisturbed atmosphere. As such conditions are rarely existent in connection with the formation of natural hoarfrost conditions, Dr. Grossmann, in order to obtain the most satisfactory and successful results, carried out his investigation with artificial hoarfrost, such as is produced in the refrigerating rooms of vessels and frozen-meat warehouses.

The process of formation of an ice crystal is as follows: A small, flat, hexagonal prism of extreme thinness springs from a solid base. Immediately this is formed there is a struggle for the attraction of material for further construction from the surrounding atmosphere. But as the outer edges of the hexagon have a wider area for attraction the molecules congregate thereat in preference to the center, forming a larger hexagon round the one beneath, with the edges overlapping. The edges thus grow more rapidly than the central face, which is left undeveloped and hollow owing to the dearth of material. This growth is continuous, and each successive hexagonal ring is larger than the preceding one so that a series of steps is produced. In our sixth illustration, which is a microphotograph enlarged twelve times, the pyramids may be seen, though it is in the fifth illustration that the pyramidical formation is best developed. In this illustration, owing to its broadside nature, the line of each step or hexagon is clearly indicated. This is the formation which all ice crystals assume, but occasionally may be found specimens

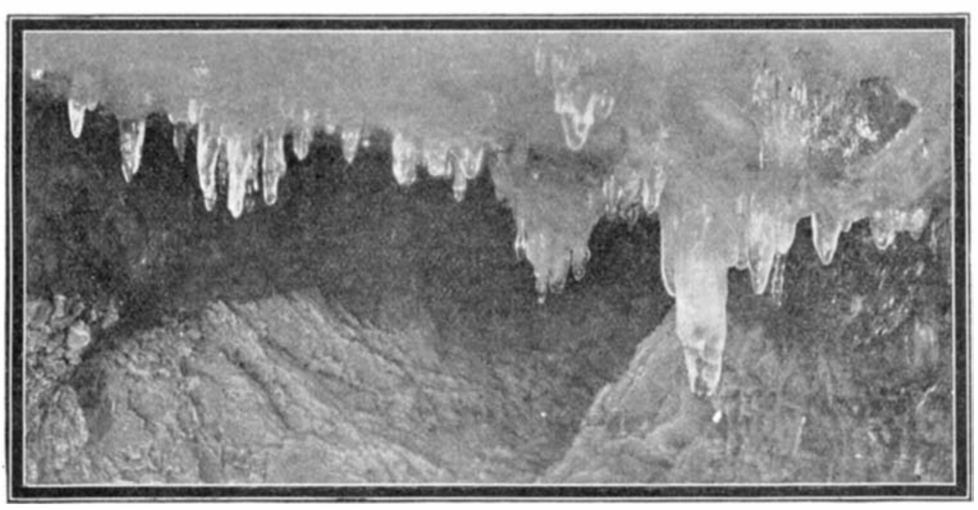


Fig. 4.—Ice Formations in an Iceland Cave at Surtshellir.

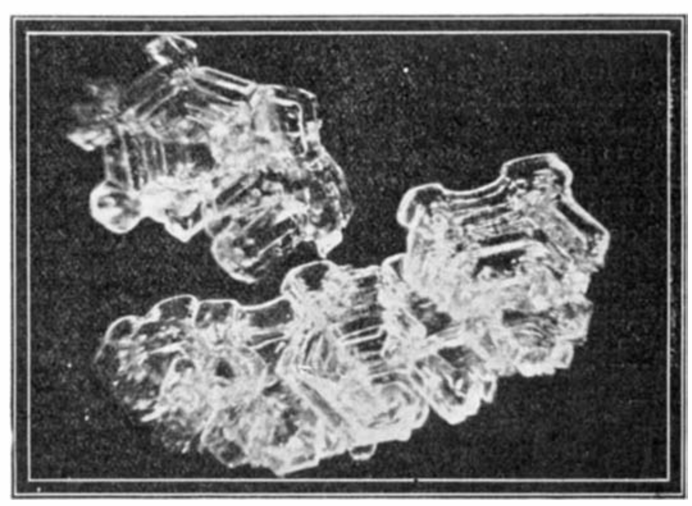


Fig. 5.—Artificial Hoarfrost—Hollow Pyramids with Corner Crystals.

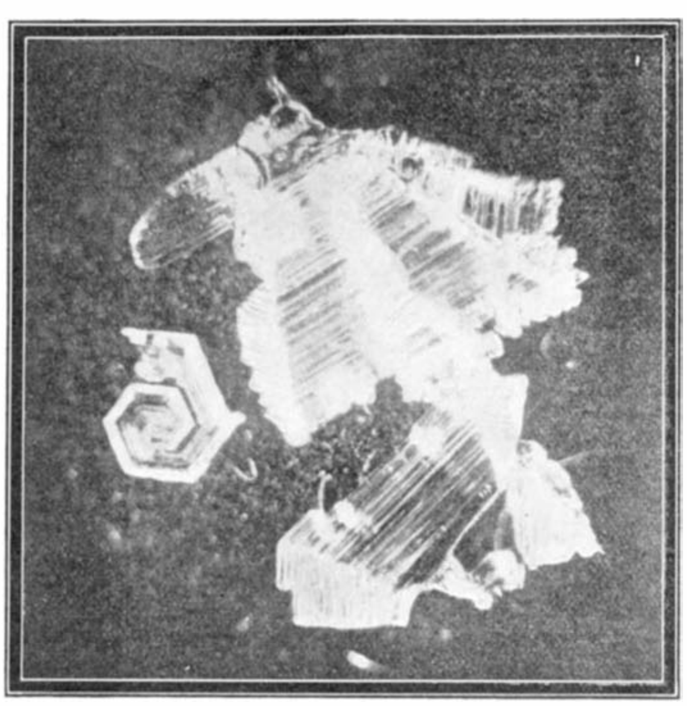


Fig. 6.—Microphotograph of Hoarfrost.

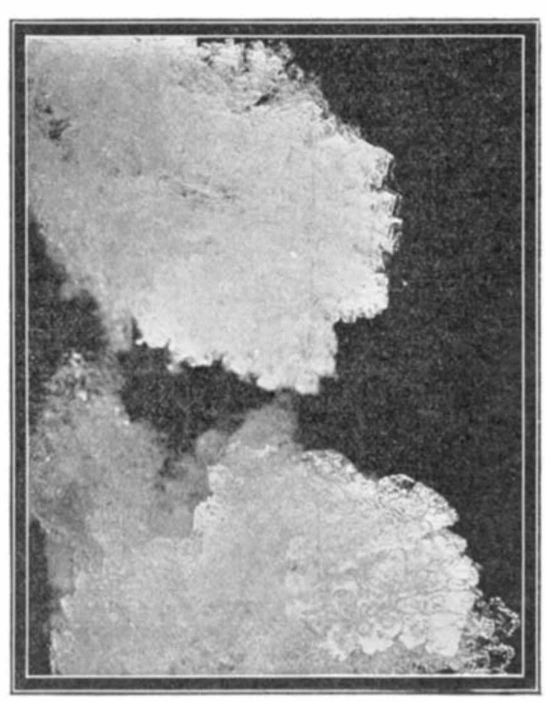


Fig. 7.—Artificial Hoarfrost.

THE ORIGIN AND FORM OF HOARFROST.

with a cube at each of the corners. This peculiarity is shown in the fifth illustration, and it will be observed that these cubical crystals, which are similar to the bastions of a fortification, are precisely the same as the cubical crystals in the rock-salt pyramids.

Dr. Grossmann during the whole of his researches, both by himself and in conjunction with Mr. Lomas, has always found the crystalline forms exclusively those of the hexagonal, flat-topped prism. In no single instance has a terminal pyramid or a hemihedral shape been discovered. In our first illustration the method of hexagonal formation is very distinctly shown, and the regularity of the hexagons is also well defined. But it has already been pointed out that exceptions to this general formation have been observed. For instance, some have been noticed to be helix-shaped hollow pyramids, similar to the cubic helices of bismuth, also long solid or helix pyramids. Sometimes a crystal will be found wherein will be noticed needle-like spikes arranged in decided right angles. Such a formation is suggestive of the cubic or other rectangular crystals, but on examination it will always be found that the prism is an incompletely developed or damaged hexagonal prism.

The helices are curious but beautiful in form, rendering an impression of the home of the smaller shellfish. In this again, however, it will be observed by reference to our illustrations that the hexagonal form is preserved. The helix is in reality an original hexagonal pyramid that has been damaged. Owing to the extreme frailty of the construction of these crystals they are susceptible to the slightest adverse influences, such as air currents caused by moving objects, or heat radiation from bodies. The result is that one or more sides of the hexagon are broken or damaged, and Nature immediately attempts to repair the injury by the formation of a smaller hexagon upon the internal surface of the former hexagonal pyramid, and thereby the helix is produced.

In our illustration of a large area of hoarfrost (Fig. 7), round the extreme edge of the frost the peculiar distinctive formation of the hoarfrost construction is distinctly shown.

THE UNITED STATES NAVAL TRAINING SCHOOL AT NEWPORT.

(*Continued from page* 144.)

divided into four classes. Those joining from the newcomers' squad are placed in the fourth class. At once they begin to participate in the regular routine and drill, embracing artillery, gymnastics, school and signals, infantry, boats, seamanship, gunnery, bags, hammocks, sewing and mending. Saturday is devoted to general cleaning of the whole building, recreation, and music. In the examinations, conduct record is the basis of determination of promotion in classes. When a boy is well versed in the subjects taught in the fourth class, able to keep himself and his clothing clean and neat and lay out his hammock for inspection and stow and lash it in the proper manner, he is promoted to the third class, and so on up to the first. Extra privileges are given to the apprentices who are first-class in studies and in conduct and who are out of debt—such as the liberty to visit Newport on Saturday afternoon once in two weeks.

The day's work begins at the training station at 5:30 A. M., when the bugle sounds reveille and the boys leap from their hammocks, which are rolled up and lashed and carried to their places. Every one is served with a bowl of hot cocoa and then the bugles sound "turn to," when for an hour there is cleaning and scrubbing all over the place. Each boy is his own laundryman and must wash his clothes, hammock, covers, bags, etc., at allotted times in the course of the day. They are dried by steam on long racks in a drying-room, and occasionally outside on sunny days. Breakfast formation is sounded at 8 o'clock, when the boys march into mess hall. These young boarders of Uncle Sam's are well and bountifully fed, the bill of fare varying according to the day.

After breakfast comes the sick call, followed by quarters and prayers. From then on till 12 o'clock, dinner time, is given up to a period of instruction, which continues, after a recess of an hour, until supper, at 5:45. After this the boys can enjoy themselves as they please, until the hammocks are piped down.

At 8:35 the bugle sounds for the piping down of hammocks. The boys sling their hammocks, arrange bedclothes and prepare their sleeping places. At 9 o'clock "taps" are heard, the day's work is done, and the four hundred apprentices spring into their hammocks. These are swung one above the other in the same fashion as between the decks of a man-of-war, and the sailor lads prefer their comfortable swinging bed to any other.

It has been said by competent experts that the battalion infantry drill as seen at the Newport Training School is equal to and even ahead of that at Annapolis. This is due largely to the efficient work accomplished by the drillmasters, notably of John R. Daly, U. S. N., instructor in infantry, sword, and bayonet exercise. Mr. Daly exercises superior control over the whole battalion and has succeeded in getting it through the most difficult evolutions in unison and with almost clocklike precision. One of the most interesting of the open-air maneuvers is the physical rifle drill with music. The whole battalion takes part in this, usually in the morning, some two hours after breakfast. This is probably the most fascinating to the onlooker of all the open-air spectacles. On a raised platform the instructors, with rifle uplifted, face the squad of apprentices, lined up in rows. At the word of command, eight hundred hands rise in the air, with rifle high above head, then lowered front and back, to and fro, quick and slow, keeping time to the music. In seamanship a typical masthead, set in the ground, with the ropes, sails and rigging, etc., of a seagoing vessel, affords the young mariners the novel and practical place to limber up their muscles in climbing and to perform other routine work. Filled from topmast down with a hundred or more of the white-clothed tars, it presents an animated sight. The U. S. S. "Hist," attached as station ship, takes some fifty boys for a week's cruise in nearby waters for instruction in practical seamanship, gun drills, signaling, etc.

Marksmanship is popular and small-arm target practice on the ranges with a service revolver is indulged in with a deal of energy and enthusiasm. There is much rivalry and competition among the boys to be the best shot. Every day a squad is taken to the ranges for practice. Each apprentice is allowed to fire a limited number of times. As an extra inducement, prizes are offered for the best scores. A boy qualifying as a first-class marksman gets a cash prize of $1.50; as second class, $1; as third class, 50 cents. Those having the highest score at each quarter get $1 additional in prize money, provided they have passed as first-class marksmen. Boxing and wrestling are favorite pastimes when off duty. A good rough and tumble wrestling bout is sure to wind up some day's recreation period, drawing a gallery of enthusiastic onlookers. Lectures, concerts, and entertainments are given on frequent evenings each month.

Apprentices of unusual ability, just after they have left the training school, are sent to the ordnance school at Washington and to the torpedo station at Newport, where they can become proficient in electrical engineering and torpedo work and qualify as divers. Those who desire to make diving in the navy a particular study enter the seamen gunners' class. Here the men are taken out morning and afternoon in a specially equipped diving boat and each one is sent down to the bottom for a limited time. After six months' work at the training school and passing satisfactory examinations, the apprentices are sent on their first cruise on one of the training ships and shipped as third-class seamen. In course of this voyage instruction in practical seamanship and gunnery is further pursued. On return they are advanced to second-class apprentices upon examinations, with increased pay of $15 a month. A transfer is then made to a regular man-of-war, and after qualification they are advanced to the grade of first-class apprentices, with pay of $21 a month, serving a year's cruise.

Upon the expiration of the enlistment of an apprentice he will, if recommended, be handed an honorable discharge and upon re-enlistment within four months from date of discharge, he will receive as a bonus four months' extra pay, a continuous service certificate and an addition of $1.36 per month to his pay.

Ex-apprentices are given the preference in the selection of petty officers with pay ranging from $17 to $30 per month and from $1,200 to $1,800 with retirement at the age of 62 years on three-quarters pay for life. This remuneration, considering that the boy gets quarters, rations, and continuous employment, with no losses or waste time, opens a satisfactory career to the determined and aspiring lad in the navy, which is not so bad financially and socially, for in fact the salary is higher than many shore positions in civil life.

Gold from Sea Water Once More.

Sir William Ramsay recently has announced that the old problem of extracting gold profitably from the sea can be successfully solved.

Newspapers of repute have given much space to explanations and interviews thereon, and even the staid Spectator devotes two columns to a consideration of its possible success and the effect thereof on the world's economy.

There are some ridiculous calculations based on alleged results. One critic solemnly asserts that 5,000,000,000 tons of solid gold await successful prospectors. The bubble has not yet been pricked, though it has been contracted in its dimensions. The weightiest authorities, speaking with gravity and becoming dignity of the exalted promoters, have expressed disbelief in the theory that it will pay to extract the gold.

The syndicate interested in the scheme is said to have employed Sir William Ramsay professionally, but seem to share with him the fear of eventual ridicule, for on a recent exposure they and he alike hastened to make statements "with a view," as they said, "of stopping possible speculative dealings by the public." At that time Sir William Ramsay wrote:

"The process is still in an experimental state. Needless to say I do not hold shares in the syndicate."

The inventor of the process by which it is hoped to make a corner in the world's gold is H. J. Snell.

We question very much whether Sir William Ramsay has stated more than the fact that sea water contains a certain percentage of gold, a proposition that no chemist will deny. Probably upon this utterance of Sir William's the London syndicate has built its extravagant claims.

Velocity Potential of the Universe.

BY EDGAR L. LARKIN.

If a hole be drilled entirely through the earth, passing through its center, and a stone be let fall into it, the stone will move to the opposite side and return to the starting point. And if air could be removed, it would oscillate to and fro so long as the earth endures. It would be a pendulum. The velocity of the falling body on arrival at the center would be 4.91 miles per second; and of the rising body, on arrival at the other side, zero. Imagine that the entire earth should be mined, removing all matter save a small mass here and there; and let all these be supported by timbers extending from mass to mass, to prevent falling to the center. Remove 99 per cent of the matter; and the stone would move with greatly reduced speed, still acting as a pendulum. Now remove all the timbers, and at the same time expand the earth to a diameter of, say, many million miles. Gravity exerted by the small masses upon each other would be weak; no supports would be required. But the stone would keep up its oscillation from side to side of the expanded swarm of earth masses, with velocity reduced in proportion to the expansion, and consequent weakened gravity.

THE UNIVERSE IS SO EXPANDED.

A remarkable computation made by Prof. Simon Newcomb (page 499, "Popular Astronomy") is based on a mass of the sidereal structure equal to that of 500,000,000 suns like ours. These are conceived to be spread out into a disk-shaped universe, whose diameter is such that the time required for light to move across it, with the velocity of 186,000 miles per second, is 30,000 years. From the known laws of gravity and motion, he shows that a stone that has been falling forever, or as he words it, "falling from an infinite distance," will on arrival at the center of the disk be moving at a rate of 25 miles per second. It is known that the force required to be imparted to a falling body to double its velocity must be quadrupled; and nine times the force is necessary to give it three times the quantity of motion. Then to cause the motion to be increased to eight times, sixty-four times the quantity of force must be exerted. Suns in space correspond to the small blocks of earth after mining out; and distances between them take the places of the timbers. The stone is represented by any flying sun. A sun may start on one side of the universe, fall through the center of gravity, pass to the other side, and return. For the purposes of this note, the quantity of matter in existence is imagined to be finite, and distributed in the shape of suns, nebulæ, and dark worlds throughout a space having a diameter of 30,000 light years, or 176 quadrillion miles. And it is imagined to have a boundary.

POTENTIAL.

If a sun could be observed near the center of this stellar structure, supposing that the center can be discovered, to be in motion with a speed of say 200 miles per second, then this would be the true velocity potential of the entire mass. Some suns now seen to be moving, are thought to have this rate. If these suns have fallen from an infinite distance, then the mass of the sidereal structure is equal to 500,000,000 $\times$ 64, or thirty-two billion times that now in our sun. The number of bodies giving light enough to impress a sensitive plate is estimated at about one hundred million, a quantity so insignificant in comparison with 32,000,000,000, that it is scarcely worth mention. However, suns starting from the periphery of the cosmical sphere would in many cases be drawn into orbits around others, and fail to become pendulums, or, in rare cases, two might collide. This would result simply in change of direction of the debris. Two suns drawn into orbits around their centers of gravity would still move on in some direction. There does not seem to be anything to prevent some suns from reaching opposite sides of the structure and then returning. According to this, it does not appear that it is necessary for an entire finite universe of worlds to be in rotation to set up centrifugal tendency to counteract collapse at the gravitation center. To accurately compute the quantity of matter, find the center of gravity of nature, its distance from the earth, and the velocity of any sun near it. That is, to find a mass that cannot be exceeded on the assumption that the moving sun has arrived in from an infinite distance.

Lowe Observatory, Echo Mountain, Cal.

WHAT WE KNOW ABOUT SUN SPOTS.

Several spots have lately been discovered on the sun, one of which, at least, is remarkable for its enormous size of 70,000 miles. In other words, this terrestrial globe might be dropped into the central chasm as a pea into a thimble without touching the sides. The whole surface is changing and breaking up constantly. The other spots are two in number, each 40,000 miles in diameter, one at each side of the 70,000-mile spot. Prof. E. C. Pickering, director of Harvard College Observatory, has kindly placed at the editor's disposal the accompanying photographs of the spots.

If we only had behind us a hundred years of good meteorological observations, and also an unbroken record of observations of sun spots and prominences, we would be in a far better position to determine the influence of the sun on the weather and to refute or affirm assertions that laws have been discovered affecting the sun's influence on the weather in such a way that we can predict whether a coming year will be good or bad for a harvest.

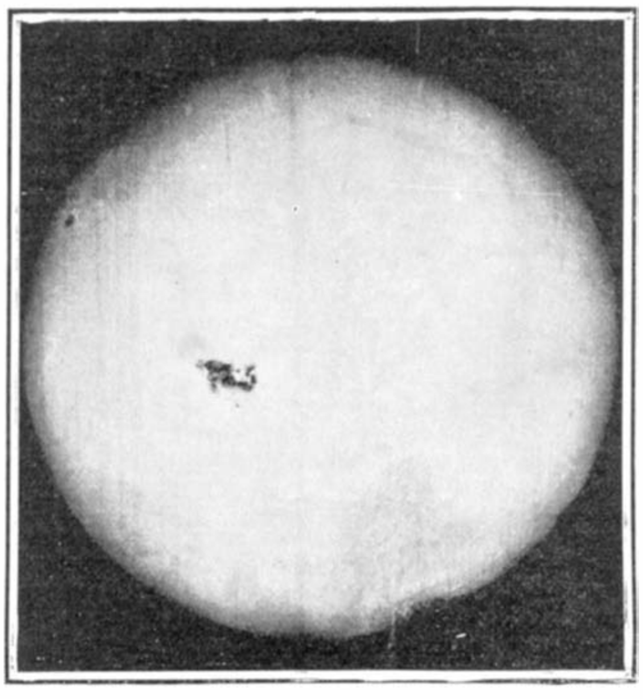
Unfortunately, meteorological records are not of any value farther back than about fifty years. In the case of solar phenomena the investigator is still more restricted; for although the observations of sun spots have been made in a more or less crude manner for many years, it was not until 1830 that systematic observation was adopted. Moreover, the solar prominences, important indicators of the sun's activity, were not recorded until 1872.

If the sun's disk be scanned from time to time, it will be found that sometimes there are spots and sometimes there are not. According to our present knowledge, these spots are projected by the descent of comparatively cool matter from the higher regions of the solar atmosphere, so that the more spots there are, the greater will be the quantity of matter descending. Since this falling material is the result of previous up-rushes of highly heated matter from the lower levels of the sun's atmosphere, it stands to reason that this spot phenomenon indicates great solar atmospheric disturbance and, therefore, greater activity, and consequently more intense heating capacity. Thus, we arrive at the conclusion that the greater the number of the sun spots, the greater the solar activity and, therefore, the hotter must be the sun.

It happens that there is a decided periodicity in the number of spots. During some years only a few spots can be seen; during others they are more numerous. This variation, it has been found, proceeds according to a fairly well defined law. The average period from one minimum to another is 11.1 years, and in every case the time from one minimum to the next maximum is less than from that on to the next minimum again. In other words the spot quantity decreases through a little over seven and increases through less than four years. We do not know in the least why this should be so; and although many attempts have been made to show that certain planets affect spots by their attraction, in the opinion of those who have considered the matter most judicially, there is no proof that they are due to any influence external to the sun itself. If the apparent law holds good, the approaching maximum will occur in about a little more than three years after the last minimum. This occurred in about the middle of 1901, and again at the end of the year 1904.

Another curious fact relating to the sun-spot cycle is that when the interval from minimum to maximum is shortest, the total number of spots included in the whole period from minimum to minimum is greatest.

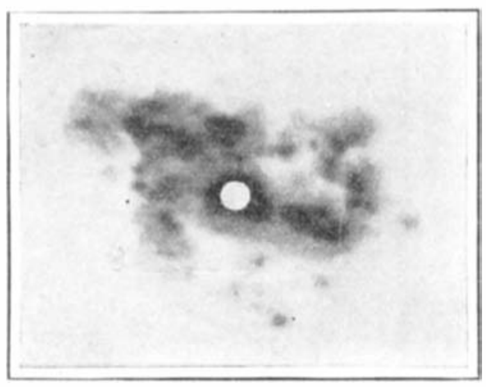
Sun spots are of interest to us because we can hardly doubt that an increase or diminution of the sun's apparent surface is in some way of consequence to our lives on the earth, when, as we know, these hang from day to day on the maintenance of the earth's heat within certain limits. If there is any influence of sun spots on the earth, the best way to detect that influence is to compare the earth's harvests with sun-spot activity in any given period. This can be done by drawing curves in the manner familiar to every engineer. Prof. Langley, by means of this method, has shown that the variations of Jupiter certainly present a striking coincidence with the changes in spot formation. This may indicate a real connection between the



PHOTOGRAPH OF THE NEW 70,000-MILE SUN SPOT, TAKEN AT HARVARD COLLEGE OBSERVATORY.

The earth could be dropped into this spot, like a pea into a thimble, without grazing the sides.

phenomena; but before we decide that they certainly do so, we must remember that the number of cycles of change presented by the possible combination of planetary periods is infinite. As Prof. Langley



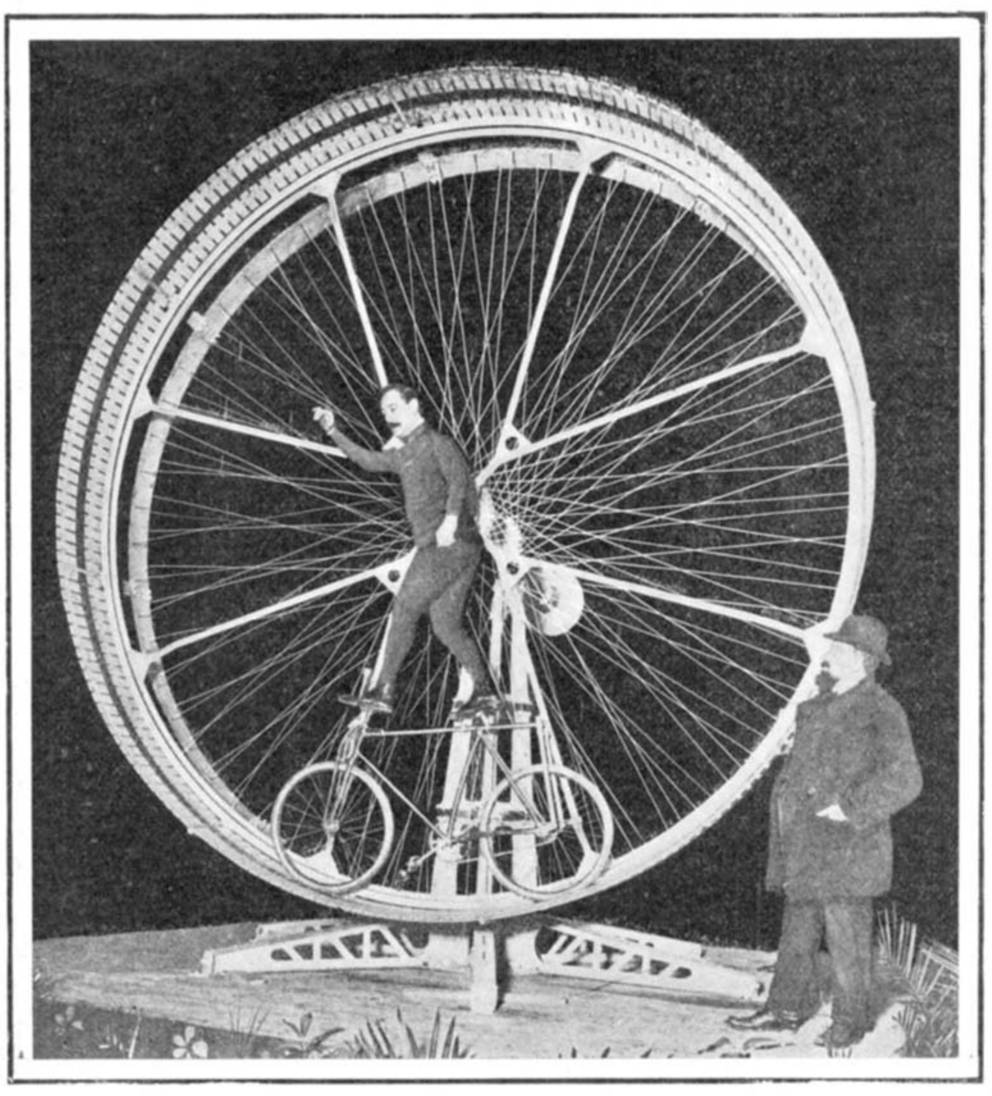
RELATIVE SIZES OF THE 70,000-MILE SUN SPOT AND THE EARTH. WHITE SPOT REPRESENTS THE EARTH.

has shown, we can safely undertake, with study enough, to find a curve depending solely on certain planetary configurations which will represent with quite striking agreement, for a time, the rise and fall of any given railroad stock, the relative number of Democratic and Republican Congressmen from year to year, or anything else with which the heavenly bodies have in reality little to do.

It has been found that the spots travel across the sun's face in about thirteen days and disappear around the western side, many of them (not all) reappearing at the east again in about thirteen days more. All the spots lie to the north or south of the equator, none of them on it. They move in belts roughly corresponding with our temperate zones. Those near the equator rotate in less time than those near the poles, very much as though the rim of a great flywheel were to make fewer revolutions per minute than one of its spokes; or the outer end of the spoke more revolutions per minute than a part nearer the axle. This may seem a mechanical paradox, and yet this is what occurs on the sun. A spot is not a solid or a liquid, but a mass of glowing vapor. It is therefore possible that one part of it may burn faster than the other. That explains the curious rotation phenomenon described. Why this should be so no one knows. We must not forget, however, that at the enormous temperatures and pressures that prevail on the sun, the conditions must be very different from any familiar to us here, so that when we speak of clouds and use like expressions, we are to be understood as applying an analogy, rather than an exact resemblance. There must be a perpetual commotion in one of these spots compared with which the most violent earthquake would seem but a gentle ripple.

Examined through a telescope of considerable magnifying power, a spot appears like an immense ragged hole in the crust of the solar surface, followed by a number of similar size. A spot is a cavity and not an elevation. As the spot turns from us, the phenomenon is similar to that of looking across the edge of a great shallow saucer, only that the outline is irregular and that where the bottom should be there is nothing but the blackness of what seems an immeasurably deep chasm. These vast cavities, as we have said, are not solid things and not properly to be compared even with masses of slag swimming on molten metal. They are rents in that bright cloudy surface of the sun which we call the photosphere, and through which we look down to lower regions. Their shape may be very rudely likened to a funnel with sides at first slowly sloping (*penumbra*), and then suddenly going down into the central darkness (*umbra*). This central darkness has its gradations of shade, for cloudy formations may be seen very obscurely glowing far down its depths; solid bottom we never see.

Near the edge of the sun's disk the spots appear to rise up through the obscuring atmosphere and gather here and there in groups of hundreds to form white cloud-like patches (*faculæ*), which may sometimes be seen even with a spyglass. Looking straight into a spot through a very large telescope, the penumbra is seen to be made up of long white filaments twisted into curious rope-like formations, while the central part is like a great flame ending in fiery spires. Over these hang what look like clouds, such as we sometimes see in our sky; but more transparent than the finest lace veil and having, not the fleecy look of our clouds, but the appearance of being filled with almost infinitely delicate threads of light. With all this there is something crystalline about the appearance of a spot, not unlike frost figures on a window pane. Indeed, the intense whiteness of everything is suggestive of something very cold.



A NEW FORM OF LOOPING THE LOOP.

The bicyclist is whirled around several times by the large revolving wheel.

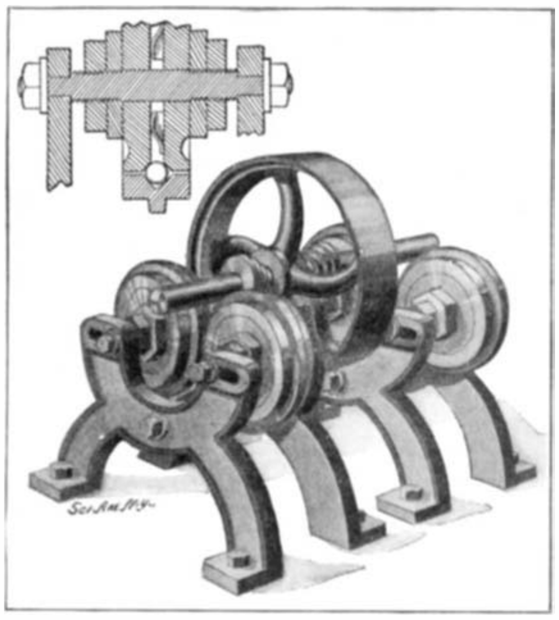
ANOTHER FORM OF LOOPING THE LOOP.

Our French contemporary Armée et Marine publishes the accompanying illustration of a fearful, hair-raising contrivance, compared with which the ordinary form of loop the loop seems as harmless as an ordinary highway.

The account given of this apparatus is not over-lucid. It seems that the performer, who rejoices in the name of Yags, throws himself within a revoluble wheel and sets it in motion by rather smart pedaling on his bicycle. When the cyclist has whipped up the speed of the large wheel sufficiently, he suddenly stops, we are assured, and allows himself to be whirled by the large wheel around and around. It is said that the cyclist in this fashion loops the loop five or six times in succession.

AN APPARATUS FOR TESTING THE BALANCE OF ROTATING BODIES.

Pictured in the accompanying engraving is an apparatus for testing the balance of high-speed rotating bodies, such as grinding and polishing wheels, pulleys, and the like. The apparatus is arranged to detect existing inaccuracies, with a view to correcting the same prior to the use of the rotating body on the machine for which it is designed, and it allows of adjustment to accommodate larger or smaller testing shafts for heavier or lighter bodies to be tested. The following is a description of the construction: The testing shaft is supported at each end between two rings which are mounted on ball bearings so as to turn with a minimum of friction. The details of one of these rings and its bearings are indicated in the section view. Supported in slots in two standards which are firmly secured to the base of the apparatus, is a spindle which carries two disks separated by a spring. Over these disks the ring above referred to is mounted. The inner peripheral edges of the disks are cut to form a V-shaped groove which, with the corresponding V groove in the ring, forms a ball raceway. The disks may be adjusted together against the pressure of the spring by means of nuts on the spindle. This permits of a very close regulation of the bearings, so as to insure perfect smoothness of action. The object to be tested is mounted on the testing shaft, as shown, and then permitted to seek its own balance, which will at once reveal any irregularity. By means of a scale the exact amount of overweight of the heavier side may be readily determined. The testing shaft may be provided with step-cones, which will fit into the central openings of articles in cases where these openings are larger than the diameter of the shaft. The rings may be shifted apart to support shafts of larger diameter by moving the spindles apart laterally in their slots. Mr. C. J. A. Heise, 58 Voorhees Street, Newark, N. J., is the inventor of this apparatus.



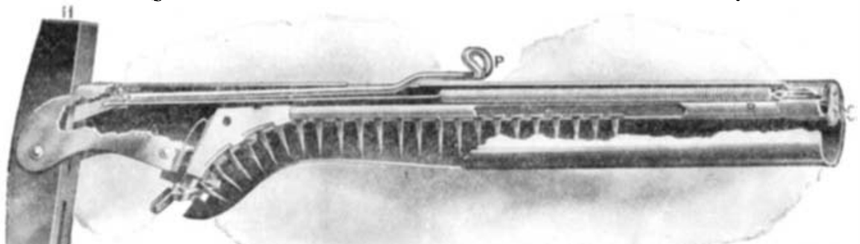
AN APPARATUS FOR TESTING THE BALANCE OF ROTATING BODIES.

A NOVEL MAGAZINE TACK HAMMER.

We illustrate herewith a very clever invention in the nature of a magazine tack hammer. The hammer carries a number of tacks in the hollow handle portion, and by a simple feeding device, the tacks are delivered singly, as required, to the hammer head, which is magnetized and thus holds the tacks in position for driving. The magazine consists of a channel or raceway, *R*, which supports the heads of the tacks, as shown. The hammer head is pivoted in the forked end of the handle, and is held in position for hammering by a spring within the handle, which, at the opposite end, is attached to a snap latch, *S*. The latter serves to close the rear end of the raceway, while an escapement device is provided at its forward end. A push rod, *P*, is attached at one end to the hammer head, and the other end projects through the upper face of the handle. By pushing this rod forward with the thumb, the hammer head will be swung on its pivots, and the magnetized or forked end, *F*, will thus be brought into engagement with the escapement device, as illustrated in one of our views. This operates the escapement which releases one of the tacks, and the latter thereupon adheres to the hammer head by magnetic attraction, so that on release of the push rod the hammer head will swing back to normal position, carrying the tack with it. When the hammer is not in use, an armature or keeper, *K*, is placed across the poles of the hammer head to conserve the magnetism. The tack magazine is loaded by means of a simple device, which quickly and readily lines up the tacks in a channel, whence they are poured directly into the raceway, *R*.

Feeding the Hammer.

Tack in Position Ready to Drive.



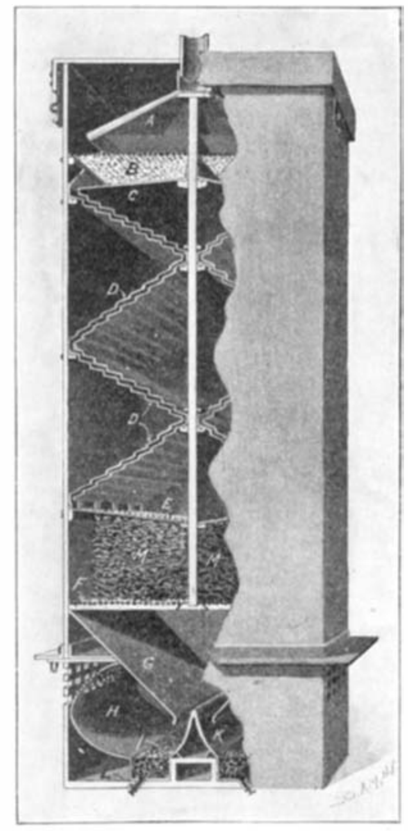
SECTIONAL VIEW OF THE MAGAZINE TACK HAMMER.

A Cotton Picking Machine.

It has been long contended that the cotton crop of this country was in a large measure limited to the number and capacity of the laborers available for the work of picking. If there was more help or if some desirable means could be devised for performing the picking operation by machine, the size of the crop would be very much greater. A great deal of ingenuity has been expended in this direction, and most of the devices which have been brought out have been minor contrivances mounted on the arm or hand of the picker with the object of increasing his capacity. Some attention has been given to the matter lately by George A. Lowry, of Boston, Mass., who has already been largely instrumental in introducing the round bale, which greatly reduced the bulk of the baled cotton. He has devised a machine on entirely new lines, which has been given a severe test in actual work. The Lowry machine is not meant to be automatic in its action, but to increase the capacity of the picker and to lighten his burdens. He is not required to stoop, reach, and lean over as is necessary with the old method of hand-packing, but instead he sits comfortably on a wagon and gathers the cotton from his perch by mechanical means as the vehicle is moved along over the fields. The machine is manned by five men, one of whom is the driver. The four pickers are distributed on either side and each one has in his charge a long arm with an elbow, which makes it perfectly flexible, and through the center of this there is a constantly moving belt with hooks at close intervals. The belt is exposed at the far end of the tube, so that as the machine passes along, the picker has only to touch the cotton boll and it is seized by the hooks and carried to the other end of the tube, where it is brushed off into a bag. This machine with four boys and the driver does the work of twenty pickers following the hand method.

AN IMPROVED AMALGAMATOR.

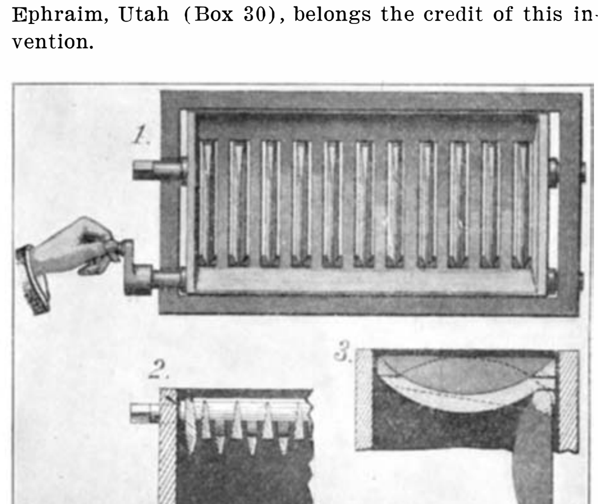
In the accompanying engraving we illustrate an improved amalgamator recently invented by Mr. B. A. Langridge, of Boulder, Colorado. One of the improvements, which will be observed at first glance, is the provision of means for locking the closures of the casing, so that the valuable contents of the amalgamator cannot be taken by unauthorized persons. But aside from this there are important improvements in the construction which will be evident from the following description of the parts. The pulp feed-pipe which leads into the top of the casing opens onto a spreader, *A*, which distributes the pulp over a sieve or a strainer, *B*, and through this it falls onto an amalgamated copper plate, *C*. Below this plate are a number of riffles, *D*, which zigzag downward between the outer walls of the casing and a central partition. The riffles are formed of parallel pairs of stepped plates so arranged that the water and pulp flowing down between them will be thrown from the lower plates against the rear of the upper plates, and then back again to the lower plates. Thus a sort of rolling motion is imparted to the water, bringing the pulp it carries into intimate contact with the riffle plates which, being amalgamated, gather all the valuable contents. The bottom riffles discharge the pulp upon perforated copper plates, *E*, through which the pulp passes into a chamher, *M*, filled with soft annealed copper shavings. These shavings are previously subjected to a bath of quicksilver so that they will arrest any valuable particles which might possibly pass the riffles. This insures the recovery of "flour gold," which ordinarily floats on the surface of the pulp and is therefore lost. The bottoms of the chambers, *M*, are formed of screens, *F*, through which the pulp passes and is guided by a shoot, *G*, against a partition wall, *K*, whence it swirls into the bowls, *H*. Outlet openings are formed near the top of the bowls, through which the tailings may be drawn off. Boxes, *I*, formed in the bottom of the bowls are filled with rocks and serve to catch any particles of amalgam which may be washed down from the plates above. These may be drawn off through the pipes, *L*. The bowls are carried in a casing which is secured to the upper or main casing by means of padlocks. A similar provision is made for securing the cover of the amalgamator to the top of the main casing.



AN IMPROVED AMALGAMATOR.

A NEW TYPE OF GRATE.

The type of grate most commonly used in stoves and ranges is the shaking grate, which is open to the objection that when it is operated to remove the ashes, coal and clinkers often wedge in between the grate and the stone lining of the stove, preventing the parts from returning to normal position. Another objection is that the shaking is often too violently done, disturbing the fire, and if fresh coal is added it is mixed with the glowing embers, cooling the fire for the time being and causing a considerable delay before it is again brought up to full heat. In the accompanying engraving we show a new type of grate which aims to overcome these objections. Instead of shaking the fire it operates to poke out the ashes in the manner that a poker is used. The construction comprises a grate proper and a poker device, the latter being provided with fingers which project through the spaces between the cross bars of the grate. The upper surfaces of the fingers are preferably curved, as indicated in the illustration, so as to extend up into the embers supported on the grate bars. The poker fingers are attached to a shaft which has bearings in the frame of the stove. Normally the fingers hang idly downward, but when it is desired to clear the ashes from the grate, they are moved into operative position by turning this shaft with a crank handle, as shown. The operation is noiseless and very simple. It may be performed rapidly or slowly, with equally good results. The grate proper is also mounted to turn on trunnions so that the contents may be readily dumped when desired. To Frederick Y. Jensen, of Ephraim, Utah (Box 30), belongs the credit of this invention.



A NEW TYPE OF GRATE.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

CABLE-LAYING IMPLEMENT. — W. C. STEVENS, Melrose, Mass. The invention relates to improvements in implements for laying electric cables or conductors either on the surface or below the surface of the ground, an object being to provide a device by means of which cables or the like may be quickly laid and covered when under ground, thus making the device particularly useful in military operations and for private and municipal uses.

RENT-COLLECTING MEANS FOR TELEPHONE SERVICE.—J. L. PEAVEY, Meridian, Miss. Mr. Peavey's invention is in the nature of an improved means especially designed for collecting the regular monthly, quarterly, or annual tolls from a subscriber for telephone service, of a simple and inexpensive character, that can be readily coupled up with the ordinary telephone-signal-bell housing, and which can be adjusted for use without disorganizing the usual arrangement of the telephone service.

ELECTROMAGNETIC APPARATUS. — J. MCINTYRE, Jersey City, N. J. The aim of this invention is to provide an apparatus designed for stimulating and vitalizing live animal, live vegetable, and other objects and matter by saturating, for instance, the whole human or animal object or the bed-soil of the plant-bed and the plants uniformly with electricity in its normal condition magnetism by the employment of frequency magnetism derived from an electric cable-coil in circuit with a source of variable electric energy or frequency electric current.

Of Interest to Farmers.

WIRE-STRETCHER.—J. MCD. SHAW and S. B. GOODE, Fannin, Miss. The object of this invention is the provision of a construction which will be simple, efficient, and cheap to manufacture and which can be made by an unskilled mechanic out of material which is usually at hand on any farm. It combines in one structure a wire-stretcher and a wire-splicer, as well as a post-puller. It can readily be knocked down and formed into a compact bundle to be transported from place to place.

INCUBATOR.—W. H. PHILLIPS, Belleville, N. Y. In this patent the invention relates to improvements in incubators for hatching the eggs of fowls, an object being to provide an incubator with a novel means for maintaining a constant circulation of air at an even temperature and in a proper moist condition.

TONGUE-SUPPORT AND SIDE-DRAFT CHECK FOR GRAIN OR GRASS HARVESTERS.—C. F. ORTMAN, Martinton, Ill. This invention relates to means for supporting the tongue or draft pole of a grain harvester and binder or a wide-cutting grass-mower, and has for its object to provide novel details of construction for a device of the character indicated, and particularly for a former patent granted to Mr. Ortman, which render this device more simple and effective.

MOTOR-PLOW.—S. E. KURTZ, Sac City, Iowa. One of the objects in view of the inventor is the provision of a self-contained agricultural implement in which the motor mechanism is so combined with the plowing or soil-stirring devices that the machine is capable of propelling itself and digging the soil at one and the same operation, these ends being secured without the use of traction wheels or other motor-driven devices that are liable to slip on the ground and fail to secure the draft necessary to make the gang of plowing devices operate in the soil.

EGG-PRESERVING CASE.—N. A. WIERMAN, Troy, Ohio. This is an improvement in the class of cases in which the eggs are held in cells in a case suspended on trunnions or journals whereby the case can be turned from time to time to prevent the yoke from settling to one side of the shell, in which position it soon spoils. Cell-partitions permit the eggs to be compactly stored, firmly held, and thoroughly ventilated and turned over without shock or jar.

CANE-CARRIER FOR SUGAR-MILLS.—H. FROEHLICH, Lihue, Hawaii. The more particular object in this case is to cause a uniform and even feed of cane to the crusher, whereby dispensing to a great extent with the necessity of manipulating the cane by hand. There are certain details of mechanism whereby the deposit of cane upon the carriers is effected uniformly and automatically and whereby the distribution of the cane after reaching the carriers and before reaching the crushers is rendered as uniform as possible.

Of General Interest.

APPARATUS FOR MAKING MOLDED COVERINGS.—J. W. WALLACE, Rutherford, N. J. The aim of this inventor is to provide an improved apparatus for making molded coverings for use on elbows, T's, valves, and other fittings on steam-pipes, brine-pipes, and other pipes and articles requiring insulation, the arrangement being such that the coverings can be quickly and cheaply manufactured and when finished can be conveniently applied and securely fastened in position.

CREDIT-BOOK.—T. G. KNIGHT, New York, N. Y. In this instance the improvement relates to blank books for the use of business-houses; and the object of the inventor is the provision of a new and improved credit-book arranged to contain credit information normally hidden from view, but readily accessible to the user of the book. It is preferred to have the leaves arranged in book form; but this may also be kept individually.

JEWEL-SETTING TOOL.—J. MCN. STEELE, Atlanta, Ga. The invention is particularly adapted for the setting of jewel-pins in the roller-tables of balance-wheels. The work can be done without removing either the hair-spring or roller-table, the balance-wheel and jewel-pin are held firmly in place while the shellac is flowing and setting, and the correct positioning of the jewel-pin is assured. Moreover, the heat can be so applied that it will raise the temperature of the balance-wheel but slightly, and thus avoids any injury from this source.

FOLDING UMBRELLA.—T. SUSEMIHL and R. L. SUSEMIHL, New York, N. Y. This invention has reference to umbrellas which may be folded for convenience in carrying, particularly when traveling. The handle sections being assembled the runner may be drawn down, and at the same time a slight shake will cause the outer rib-sections to fall into alinement with the inner sections. The frame may now be raised by the runner in the usual manner. The umbrella is closed in the customary way; and to fold the device the operations are substantially reversed.

MANUFACTURE OF CONCRETE ARTICLES.—J. L. SHOUGH and R. W. LEVITT, Somerset, Ohio. In this case the object of the invention is to provide certain new and useful improvements in machines for molding concrete articles—such as building-blocks, caps, sills, and the like—whereby the articles are pressed accurately to the desired shape and provided with an ornamental face.

SHOULDER-BRACE AND SUPPORT.—ANNIE STINTON, North Williamstown, Victoria, Australia. The invention is an improvement in shoulder-braces and supports, and has for an object to provide a construction designed to support the body, assist in the carriage, and supplement or replace corsets. In practice the straps may be of webbing, leather, or other suitable material, and buckles may in some instances be used in lieu of tapes as fastenings; but tape or ribbons are preferred, because of the ease with which the user can secure and adjust the device upon the body.

WATCH-FOB-ATTACHING DEVICE.—S. J. PERRY, Spokane, Wash. Mr. Perry's object in this invention is to provide a device that will be simple in construction and so arranged as not only to serve for attaching a fob chain or ribbon to a watch, but to secure the watch in a garment-pocket, thus preventing loss of the timepiece by accidental dropping out of the pocket or through the manipulations of a pick-pocket.

REGISTERING-TARGET.—J. N. MICHEL, New York, N. Y. The object of the invention is to produce a target of improved form at which a projectile, such as a ball, may be thrown by hand and to provide in connection with such a target a registering mechanism by means of which the point at which the projectile strikes may be indicated.

TEMPORARY BINDER.—S. H. MCVITTY, Bryn Mawr, Pa. In carrying out the invention Mr. McVitty has in view so constructing the binder that it will be adapted to retain a number of periodicals without tearing or marring the same, thus enabling the periodical to be removed from the binder at any time and permanently bound. He provides a binder which will always leave a full view of every part of the periodical; a great advantage over binders now generally in use, in which the middle portion of the periodical is obscured by binder-fastenings.

METAL STRUCTURE AND ANCHORAGE THEREFOR.—J. L. HOLMES, Butte, Mont. The aim of the inventor is to provide a structure and anchorage therefor more especially designed for forming reservoirs, dams, and the like and arranged to withstand the pressure of the water without the use of abutments and other costly masonry and to allow of quickly erecting the structure and in the case of a dam to permit its erection without interfering with the flow of the water.

HYGROMETER ATTACHMENT.—J. H. GERBER, Elreno, Oklahoma Ter. The intention of this inventor is to provide an attachment to be applied to glass inclosures in such a way as to indicate the degree of moisture inside without having to open the inclosure—that is to say, the hygrometer is so formed as to be attached directly to the inside surface of the glass and to show the hygrometric scale throughout the glass, so that it may be conveniently read from the outside of the case or inclosure and without taking up any valuable space within the case. Designed more especially for cigar-cases, it may be for use in incubators, hothouses and the like.

MUZZLE.—W. A. FOSTER, Goreville, Ill. The invention refers particularly to improvements in muzzles for horses, mules, or the like, the object being to provide a muzzle of simple and light yet strong and lasting construction that may be readily adjusted as to size and when in position will not interfere with the portion of the bit in the animal's mouth and also to provide a close-fitting muzzle which cannot be removed by the animal when in use.

PIANO DAMPER-ACTION.—W. A. EARHART, Pittsburg, Pa. In this patent the object of the invention is to provide a new and improved piano damper-action for both grand and upright pianos arranged to automatically damp the strings not sounded at the time to keep the unused strings from vibrating in unison with the strings sounded by the hammers.

SWING.—H. H. DEFRANCE and C. O. GARRISON, Golden, Col. The swing is suspended from a carriage running on a track supported on a frame. It further consists of means for locking the carriage at one end of the track and holding it there until the swing moves to a predetermined height, when it automatically unlocks the carriage by its momentum on the forward movement after the swing has passed a perpendicular line through the center of the carriage moves the carriage to the other end of the track, where it is again locked in a similar manner.

MAIL-POUCH FASTENER.—A. L. DAVIDSON, Lesterville, S. D. Mr. Davidson's invention has reference to novel means for the purpose stated, and has for its object not only to improve and simplify the fastening device, but to provide means whereby the pouch or sack may be quickly closed and secured or locked closed in one operation.

GAME APPARATUS.—W. H. CLAGETT, New York, N. Y. This invention relates to a game apparatus particularly adapted for indoor use and by which a friendly racing game may be played by two or more players and also through the medium of which the various possibilities in a running, trotting, or steeple-chase race may be made apparent and properly counted.

PLAYING ATTACHMENT FOR MUSICAL INSTRUMENTS.—J. A. CAMERON, New York, N. Y. The aim of the inventor is to produce an attachment which can be connected with an automatically-playing instrument in such a manner that the player is not depending upon any controlling device, such as a perforated music-sheet, and whereby a person even without ability to play on the keys in the usual way can control the playing of proper notes by means of a mouth-piece somewhat resembling an ordinary mouth-harmonica.

DISPLAY-CARD HOLDER.—C. C. GOETZ, Natchez, Miss. While this device is intended, primarily as a holder for a display-card, it affords means also for supporting a small bolt of the material to be sold, from which bolt or roll small samples of the material may be detached. It combines two very useful features, namely: marks for the identification of the goods, and a suitable and handy receptacle for the samples. The fixtures are easily attached to the bolts and sample after sample may be cut without removal of goods from the shelving.

HAIR-DRYING COMB.—A. WALLACE, JR., New York, N. Y. The invention has for its object the provision of an effective device by means of which women may conveniently dry their hair after shampooing or washing the same without the inconvenience of exposing the hair to air-currents or to the action of the sun, and without excessive rubbing with towels or the like.

NON-REFILLABLE BOTTLE. — F. L. SHORT, St. Louis, Mo. This device provides a closure which may be manufactured at a low figure, will not get out of order, and effectually prevents the refilling of the receptacle with liquid after the original contents have been poured out. Moreover it does not materially interfere with the free delivery of the liquid. After emptying the bottle to which the device is applied the former may be broken to release the closure, which may thus be used repeatedly.

SHOE-SUPPORTING BRACKET.—F. J. SIMS, New York, N. Y. The principal object of the invention is to provide a bracket formed of wire and characterized by great cheapness, while possessing great durability and high efficiency. A further object is to provide a bracket which is attractive and will grip a shoe very securely without injuring or marring the shoe in any way.

MILEAGE-DETACHER.—J. SHARKEY and J. A. MENEFEE, Eaton, Ohio. The purpose of the inventors is the provision of an instrument for measuring and severing railroad-scrip, particularly mileage-scrip, and to so construct the instrument that it will be light and compact and may be conveniently carried, which will be accurate in operation, and can be readily and expeditiously operated.

Heating and Lighting.

INCANDESCENT GAS-BURNER.—A. A. PRATT, New York, N. Y. The inventor's object is to provide a burner arranged to allow minute adjustment for producing a proper mixture of the gas and air, especially by preventing loss of force in the stream of the gas and a swaying thereof from an axial direction to prevent carbonization of the mantle and backflashing of the flame, also to regulate the amount of the light more or less without using the ordinary cock of the gas-fixture.

STEAM-HEATING APPARATUS. — W. SHURTLEFF, Moline, Ill. In this instance the inventor has devised an improvement comprising means connected with the usual steam-heating apparatus whereby air and surplus steam are drawn off from the radiators and boiler automatically, this operation occurring intermittently at any predetermined steam-pressure.

FURNACE ATTACHMENT.—G. WOLF, New York, N. Y. This invention relates to improvements in attachments for heating-furnaces for supplying atmospheric air to the interior or combustion chamber of the furnace, an object being to provide a device for supplying air in a highly-heated condition directly over the products of combustion, whereby there is a complete mingling of the air with the gases, the combustible gases being burned.

GAS-GENERATING FURNACE.—J. H. FOSTER, New York, N. Y. The object of this invention is to secure a perfect impact of the products of combustion on the boiler-tubes, and to provide a perfect combustion at high temperature, insuring a perfect oxidation of the fuel. The prime features are to provide a burner or retort that fires its gases parallel with its base and against highly-heated walls, which by radiation and deflection conduct the products of combustion uniformly to the boiler, dispensing with all baffle-plates, as the side walls act largely in such capacity.

Household Utilities.

DISAPPEARING WINDOW.—J. J. MULLER, New York, N. Y. In this case the improvement refers to the construction of window casings and sashes, together with their attachments, the object of the invention being to produce an arrangement whereby the sashes may disappear in the casement of the window or in a wall in order to increase the area of the opening of the window.

COMBINED SHADE AND CURTAIN HANGER.—T. V. EDWARDS, St. Louis, Mo. The inventor employs substantially duplicate horizontal members with means for attachment thereof to opposite sides of the facing of an ordinary window-frame and having stationary supporting means for the ends of an ordinary shade-roller. Mounted upon said horizontal members are adjustable members, also having means for supporting ends of a roller or the like, while additional adjustable members are mounted upon the horizontal members and with means for supporting the ends of a curtain rod or pole. The elements employed are strong, durable, light in weight and easily applied for use.

METALLIC WINDOW FRAME AND SASH. —P. A. TRACY, New York, N. Y. The invention has for its object the provision of a thoroughly fireproof window-frame and sashes cooperating therewith of durable and simple construction, in which the parts are so designed and arranged that the window-frame occupies a minimum amount of space and is adapted for use under a great variety of conditions.

Machines and Mechanical Devices.

LIFTING AND DROPPING MECHANISM.—A. D. DUCHOW, Sonora, Cal. Mr. Duchow's invention relates to improvements in lifting and dropping mechanism—such, for instance, as the lifting and dropping of weights for pile-driving, drop-hammers, pumps, well-drills, etc.—an object being to provide a machine of this character that will be simple in construction and positive in action.

MACHINE FOR PLACING BRUSH MATERIAL IN BRUSH-BACKS.—C. W. SMITH, New York, N. Y. This inventor provides a machine practically automatic, wherein the brush-back is manually presented to receive brush material, and so constructs the machine that it separates bunches of material from the mass contained in the general receiver and which conveys the separated bunches to staples previously cut by the machine and placed in receiving position. A fork acts to force the brush into the staple, certain means close the staple over the bunch at a point between ends of the bunch. The fork delivers a bunch to a staple and finally combs the brush material upward from the staple. Nippers engage the combed bunch and hold it in combed position for a predetermined time.

SAW-TABLE.—C. SEYMOUR, Defiance, Ohio. Mr. Seymour's object in this invention is to provide a new and improved saw-table arranged to permit convenient and accurate adjustment to allow the saw band or blade of the swing-ing-machine to make straight or beveled cuts on the work. The present is a division of the application for Letters Patent of the United States formerly granted to this inventor, and it has many advantages in operations which include unlocking, swinging, locking or tilting of the work-table.

TYPE-WRITING MACHINE.—S. A. THOMPSON, New York, N. Y. The machine comprises a base upon which is mounted a fixed support for a type wheel, the support being of special construction whereby the type wheel is held inclined with reference to the platen and also whereby the same is returned to normal position on each release of pressure applied thereto for spacing purposes. The platen and paper-feed devices are mounted in a traveling carriage comprising a movable member constituting a guard for the paper passing over the platen, the member being of special embodiment whereby longitudinal step-by-step movement of carriage is effected and also whereby paper-feed devices are operated.

MACHINE FOR IMPRESSING OR EMBOSSING AND DRYING STEREOTYPE-MATRICES.—F. SCHREINER, Plainfield, N. J. Stated in general terms, the object of this invention is to provide a machine characterized by simplicity of design, durability and inexpensiveness of construction, and by means of which perfect stereotype-matrices may be simultaneously impressed or embossed and dried, thereby effecting a material saving of time and expense in the production of such matrices.

AUTOMATIC DUMPING ORE-ELEVATOR.—D. B. McTaggart, Butte, Mont. In carrying out the present improvement the inventor has particularly in view providing an automatic side-dumping elevator or skip for hoisting, lowering, and automatically discharging coal, ore, or other materials in mines, which skip shall embody the essential features of simplicity, durability, and economy in installation. The safety-clutch mechanism prevents the car being dashed to pieces at the bottom of the shaft in case the cable parts.

MOLDING-PRESS.—C. H. Darling and H. Rhead, Trenton, N. J. The invention refers to a molding-press capable of use for molding all plastic substances, but especially applicable for the manufacture of tiles from clay. The object of the inventors is the provision of a power-operated molding-press with means whereby the operations ordinarily performed in hand-presses may take place automatically and without the intervention of any manual control.

SHIP'S WINDLASS.—C. W. Blake, Norfolk, Va. The principal object in this case is to provide means for overcoming the effects of pulls upon the anchor chains or cables, hawser chains or cables or other chains or cables of the vessel caused by undue surging of the vessel produced by motion of the sea, more especially when the vessel is at anchor, or being weighed, or when the vessel is being towed in a heavy sea or swell. The invention refers more especially to windlasses, hoisting-drums, winches, capstans, towing-machines, steering-gears, etc.

Prime Movers and Their Accessories.

SANDER FOR LOCOMOTIVES.—G. W. Frazier, Alamogordo, New Mexico. In this patent the invention has reference to sanding devices for use on locomotives to prevent slipping action of the drivers upon the rails. The invention has for its object to simplify and improve certain details of construction, more particularly the sand feed or cut-off valve devices.

ENGINE FOR OPERATING CLAM-SHELL BUCKETS.—J. G. Delaney, Newark, N. J. This invention relates to an engine for operating clam-shell buckets, the same being equipped with a traversing and a non-traversing drum and applicable to machinery for dredging and for excavating purposes generally, although the invention in whole or in part may be used at will in the arts.

BACK-PRESSURE RELIEF-VALVE.—C. A. Cunningham, Brainerd, Minn. The object of the inventor is to provide a valve arranged to completely relieve the piston on the steam-cylinder of all pressure over and above steam-chest pressure, thus insuring a steady running of the engine and utilization of the motive agent to the fullest advantage and relieving the piston of all pressure when the engine is drifting.

ROTARY INTERNAL-COMBUSTION ENGINE.—T. Wright, Jersey City, N. J. Mr. Wright's improvement relates to that class of internal combustion engines in which one or a plurality of cylinders and pistons are arranged to turn around a stationary crank-shaft, the piston-rods being connected to the crank and power being taken from the outer ends of the cylinders or from some part in connection with the cylinders.

BOILER-FURNACE.—G. Wolf, New York, N. Y. This invention relates to improvements in attachments to tubular steam-boilers for supplying air in a heated condition to the boiler-furnace for promoting combustion and the burning of the gases. In certain devices air is so admitted as to pass off with the draft through the combustion-chamber, and does not effect the purpose designed. The object here is to provide a boiler attachment so arranged as to practically direct hot air into a portion of the combustion-chamber, causing a thorough mixture with and complete burning of the gases, resulting in intense heat, and economy in fuel.

FEED-WATER HEATER AND PURIFIER.—T. O. Organ, Philadelphia, Pa. In the present patent the invention has reference to an apparatus for heating boiler feed-water by the aid of exhaust steam, for filtering the feed-water, extracting the oil from the exhaust-steam, and also for receiving the drip from the heating system.

Railways and Their Accessories.

CABOOSE-LIGHT.—R. L. Massey, Grand Island, Neb. Mr. Massey's invention relates to lights adapted for indicating "safety" or "danger," and has for its objects ready and simplified means adapting the light to be set from within the caboose and which means shall operate automatically, restoring the light from "safety" to "danger" upon withdrawing the safety-signal and *vice versa* when the danger signal is withdrawn.

RAPID-TRANSPORTATION SYSTEM.—E. W. Curtiss, New York, N. Y. Broadly stated this invention comprises two platforms constantly rotating in contact with an endless train of cars, the object being to have platforms large enough so that while they travel at the same rate as a train of cars at their circumference—say fifteen miles an hour—their rate of motion near the center will be much smaller—say two an hour—so that people can board platforms near the center and proceed to the circumference, where they can board cars without any difficulty due to change in speed between any two moving parts.

RAIL-JOINT.—T. E. Laroy, Ehrmandale, Ind. The object had in view by this inventor is to provide means in the make-up of joints for railway rails whereby improved fastening of the rails may be effected by means which shall also brace the rails against spreading action. The rail-joint has advantage over similar joints in the means employed for locking the chair and braces to the rail and in the special construction, arrangement, and combination of parts forming the joint.

RAIL-JOINT.—W. J. Forsyth, New Iberia, La. The aim of the invention is to provide a rail joint or union which will form a very substantial and secure connection between the abutting extremities of adjacent rails for the purpose of increasing rigidity and preventing the undesirable jars or shocks which may occur at rail-joints as the wheels pass over them.

BRAKE-RIGGING.—J. M. Davies, Jr., Plattsburg, N. Y. In its preferred embodiment this invention comprises a combination with connections for transmitting the braking force, said connections including a shiftable part and devices for operating the part, the operating devices being themselves actuated by the relative movement of the car-body and trucks due to the absence or pressure of a load on the body. The present is a combination of a copending application filed by this inventor.

CAR-COUPLING.—J. Anson, Cooper, Canada. The object of the inventor is to provide features of construction for a car-coupling of the Janney type, which enable the use of the car-coupling when the knuckle-jaw is broken and, furthermore, which permits the improved knuckle to be employed as a coupling-link in case the car-coupling is to be coupled with the draw-head of an ordinary link-and-pin car-coupling or a Janney coupling having a broken knuckle.

RAILWAY-SWITCH.—W. K. Smith, Denver, Col. Mr. Smith's invention refers to improvements in switches for street-railways, his object being to provide a switch mechanism of novel construction adapted to be operated by a motorman on a car while the car is moving. Among the many advantages are those in relation to weather conditions. The opposite edges of a shifting-plate are sharpened so that when sliding on the cover any ice or snow thereon will be readily cut by the sliding plate. This cover is provided with an opening through which the tapered rail may be passed into position. This opening, however, is normally closed by another cover seated on a gasket of rubber or the like, to prevent the entrance of water.

Pertaining to Vehicles.

VEHICLE-BRAKE.—A. J. Jacobs, 33 Salisbury road, Redland, Bristol, England. The object in this instance is to provide perambulators, mail-carts, and other three or four-wheeled vehicles propelled by hand with means whereby on the release of the handle-bar or shafts a brake will be automatically applied to the wheels, the construction being such that the brake will be automatically held off whether the vehicle is propelled by means of handles either in the forward or backward direction or is tilted backward as in mounting a step or curb in the forward direction, or is tilted forward, as in mounting a step or curb in the rearward direction.

AUTOMOBILE.—Arba Holmes and Albert Holmes, Carroll, Iowa. The invention of the Messrs. Holmes relates particularly to a knuckle-joint construction designed especially for use in connection with wheels of automobiles. The inventors have improved a joint of this character in certain particulars largely with a view of incasing the same and protecting it from dust and moisture and incidentally to provide an oil cup within the casing.

WHEEL.—J. C. Raymond, New York, N. Y. The invention is an improvement in wheels, and particularly in the means for securing the tire in place, and has for an object the provision of a simple novel construction by which the tire may be securely held and may be readily removed and replaced whenever desired. When the tire is inflated the parts are arranged to operate to prevent any displacement of the tire and yet permit the same to be quickly removed and repaired and replaced or another substituted, thus avoiding delays in use of the invention.

CHILD'S CONVERTIBLE CARRIAGE.—J. A. Crandall, New York, N. Y. In this instance the improvement has reference to a child's carriage; and the particular objects of the invention are to provide means for converting such carriage at will into a go-cart or a crib and the provision of means for permitting such changes to be made readily and without complicated adjustment of the parts or the use of instruments of any kind.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

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(9536) X. Z. says: 1. Is there any system in use where electricity is used under hot water or steam boilers for heating purposes? How much more expensive would it be than egg coal at $6 per ton of 2,000 pounds? In the case I have reference to, it could not be applied direct, as there would be too much danger from fire, and besides it is too dry a heat. A. In reply to your questions, we would say that it would never be feasible to use electricity under hot-water or steam boilers for heating purposes unless the quantity of heat desired was very small indeed, or the cost of the electricity almost nothing. As a rule, steam is required to generate electricity, and only from 1-6 to 1-10, or in some cases 1-20, of the heat required to generate electricity could be again utilized for heating purposes. It would also be difficult to obtain electrically a temperature hot enough to generate steam. 2. Which is the most economical for heating—hot water under 2 pounds pressure or under 40 pounds pressure? A. There is no difference in the economy of hot-water systems between those which operate under high pressure and those which operate under low pressure. With a high-pressure system there is slightly less heating surface required. 3. Which is the most economical from a *fuel* standpoint (for heating a building say 10 x 50, even span, sides 4 feet, ridge 10 feet) steam or hot water? Are there any records of experiments carried on in a first-class, practical way regarding steam versus hot water? A. There is no difference in economy between hot-water and steam systems, both giving the same results when properly installed.

(9537) H. A. Wright says: Will you kindly advise as much in detail as possible, what is known about the tempering of bronze and copper? A. Bronze and copper cannot be tempered in the ordinary sense of the word. Suddenly cooling them in water does not produce the same character of change that is produced in tool steel when subjected to the same treatment. Both copper and bronze, however, can be hardened to a considerable degree by hammering or by rolling them when cold, but the character of this change is similar to the change that is produced by cold-rolling steel shafting or wire, excepting that perhaps it is somewhat more pronounced. Bronze is a composition of copper, tin, and zinc, and varies very much in hardness according to its composition. By using just the proper portion of copper and tin, an extremely hard metal may be obtained: but such a metal cannot be obtained by any process of tempering or hardening from the soft varieties of bronze without remelting and changing the composition.

(9538) U. M. C. says: Can you furnish me with a rule for finding approximately the M. E. P. of a steam engine, without the use of an indicator? A. The M. E. P. of a steam engine can be estimated only very roughly without the use of an indicator. If the point of cut-off is known, and the point of compression is known, it is possible to draw to any convenient scale an indicator diagram which will very roughly approximate the true indicator diagram. This can best be done by comparison with the indicator diagrams of similar engines. By measuring the area of such an assumed diagram, dividing this area by its length, and multiplying this result by the proper scale, the M. E. P. may be approximately obtained.

(9539) M. & L. say: Some time since we purchased of you at your suggestion a work entitled "The Brass and Iron Founder's Guide." We cannot find therein the formula and particulars of a certain bearing metal entitled "French automobile bronze," the peculiarities of which are hardness in the extreme with good working qualities, nevertheless, and also a certain resistance to friction heat. Could you oblige us by giving us this formula? If you do not know it, could you furnish us with a formula for a metal of this character? A. There is no special peculiarity in the bronze bearing metal used in French automobiles over any other first-class bearing metal; the composition is just the same. A good formula to use for such a bearing is: 88 per cent pure copper, 10 per cent tin, 2 per cent zinc. A very slight variation in the proportion of any of the above percentages will cause a considerable change in the character of the metal. To obtain exactly the degree of hardness and toughness that is desired, requires considerable skill in mixing. Sometimes one per cent or one per cent and a half of lead is added to the above mixture, in order to make metal more easily worked in the machine shop.

NEW BOOKS, ETC.

CYCLOPEDIA OF APPLIED ELECTRICITY. Five volumes. Prepared by the American School of Correspondence at Armour Institute of Technology. Chicago, 1905. Large 8vo; 2,500 pages; 3,000 illustrations. Price, $30.

This is a very comprehensive work on electricity, dealing particularly with its practical applications and avoiding all unnecessary digressions into theory. Well-known specialists in the different branches covered have aided in the collaboration of this work, contributing specially-prepared articles, and all the standard works on electrical subjects have been consulted and freely drawn upon. Primarily, this cyclopedia is intended for the use of students, the matter being arranged in the progressive order in which it is usually taught, instead of being alphabetically arranged. Examples are used throughout, in order to give a practical understanding of the various subjects, and at the end of each volume are a series of review questions, which permit the reader to examine himself and test the knowledge he has acquired. But though the work is thus particularly adapted for students, it is none the less of value to electricians, engineers, telephone and telegraph operators, and all who are interested in the practical side of electricity. Higher mathematics is avoided, and only the simplest equations are used. All the explanations and descriptions are extremely simple and clear, and at the same time they are very thorough and complete. A common fault with most general works on electricity is the free use of technical terms without explicit definitions of their meanings. In the present work the simplest language is used, and technical terms, while not avoided, are fully explained before being introduced.

The first volume deals with the elements of electricity, electrical measurements, electric wiring, insulators for transmission lines, and telegraphy, including a comprehensive chapter on wireless telegraphy, and one on the telautograph. Electric welding is also described in this volume. The second volume describes direct-current dynamos and motors, with a valuable chapter on electric motors in machine-shop practice, and another on storage batteries. Volume III covers the subjects of electric lighting and electric railways, dealing also with power stations and management of dynamo-electric machinery. The volume contains in addition a chapter on boiler trials. The fourth volume takes up alternating-current machinery and power transmission, describing all the principal types of alternators, synchronous motors, induction motors, etc., also converters, including a chapter on the mercury-vapor converter. In the fifth volume telephones and telephone practice are dealt with. This is a complete and very practical book on the subject, written by William C. Boyrer, who is a telephone engineer of wide experience. The volume ends with a chapter on wireless telephony and a complete index of the entire cyclopedia.

MODERN INDUSTRIAL PROGRESS. By C. H. Cochrane. Philadelphia: J. B. Lippincott Company, 1905. 12mo.; pp. 647; over 400 illustrations. Price, $3.

Mr. Cochrane's book, although not an original work, must be considered a most successful attempt to popularize modern engineering. He has described tersely, though vividly, the foremost technical achievements in civil engineering, steel-making, photography, wireless telegraphy, farming, glass-making, and most of the important American industries. The illustrations in the book vary in excellence. Some are extremely good and some nothing more nor less than catalogue cuts, which ought to have no place in a volume of this character. Apart from this defect, the book is one that can certainly be recommended to the non-technical reader.

RADIUM. And All About It. By S. R. Bottone. New York: Whittaker & Co., 1904. 12mo.; pp. 96. Price, 50 cents.

One of the latest of the popular manuals on recent scientific discoveries and inventions, which Mr. Bottone has been publishing in London. "Radium" is entertainingly written and well illustrated.

FRICTION AND LUBRICATION. A Handbook for Engineers, Mechanics, Superintendents, and Managers. By William M. Davis. Pittsburg: The Lubrication Publishing Company, 1904. 12mo.; pp. 265. Price, $2.

In these days of rigid economies and close attention to details, the engineer or manager who desires to attain to the greatest efficiency and economy in the operation of machinery in his charge must consider closely the cost, the quality, and the best methods of applying lubricants, as well as of fuel and the other elements which enter into the operation of a steam plant. The author is a practical engineer, who has made a special study of lubrication and is in a position to impart sound advice.

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Watches, watchcases, and watch movements, Philadelphia Watch Case Co., 44,149, 44,150
Water, compound for use in the purification of, R. T. Weaver 44,135
Water purifying apparatus, certain named, R. T. Weaver 44,134
Weeds, liquid preparation for destroying, A. Klokner 44,146

LABELS.

"Chocolate Figola," for confectionery, H. M. Goldsmith 11,849
"Ferrum Vitae," for medicine, Sackett Pharmacal Co. 11,846
"Friction-Grit," for powder, G. F. Eppley .. 11,847
"Golden Rule Hazel Cream," for toilet cream, Citizens' Wholesale Supply Co. 11,848
"Live Oak Pork and Beans," for canned pork and beans, Jersey Packing Co. .. 11,851
"May Flower Brand," for citrus fruits, R. J. Richardson 11,850
"Neu-Nicotin," for cigars, E. J. Harter .. 11,840
"Ni-Ko," for tea, A. Koppel 11,844
"Old Overholt Whiskey," for whisky, A. Overholt & Company 11,841
"Red Cross Ginger Ale," for ginger ale, Bluff City Bottling Co. 11,842
"Royal Blossom," for a beverage, B. Amar 11,843
"The Cupid's Dart and Target," for a game, Game & Dart Manufacturing Co. 11,853
"The New Musical Game of Cards," for playing cards, I. Logan 11,852
"Tycoon," for tea, A. Koppel 11,845

PRINTS.

"Horse and Wagon Advertisement," for books and periodicals, W. A. Downer ... 1,201
"Jack Knife Jack's Marvel," for knives, J. Kaplan 1,200
"Pileoff," for drugs, Pileoff Co. 1,198
"Resolved that I dyed my name Brown," for dyes, Paas Dye Co. 1,199
"Spring and Summer Clothes," for apparel, David Adler & Sons Clothing Co. 1,197

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.