SCIENTIFIC AMERICAN

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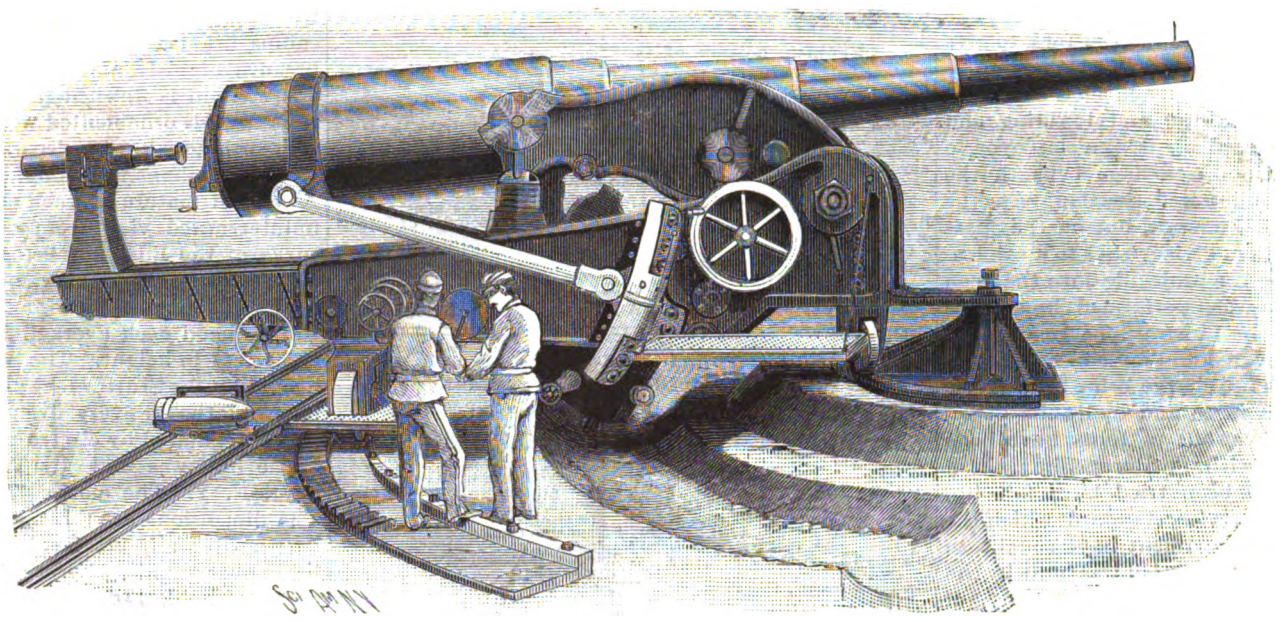
THE DISAPPEARING GUN CARRIAGE.

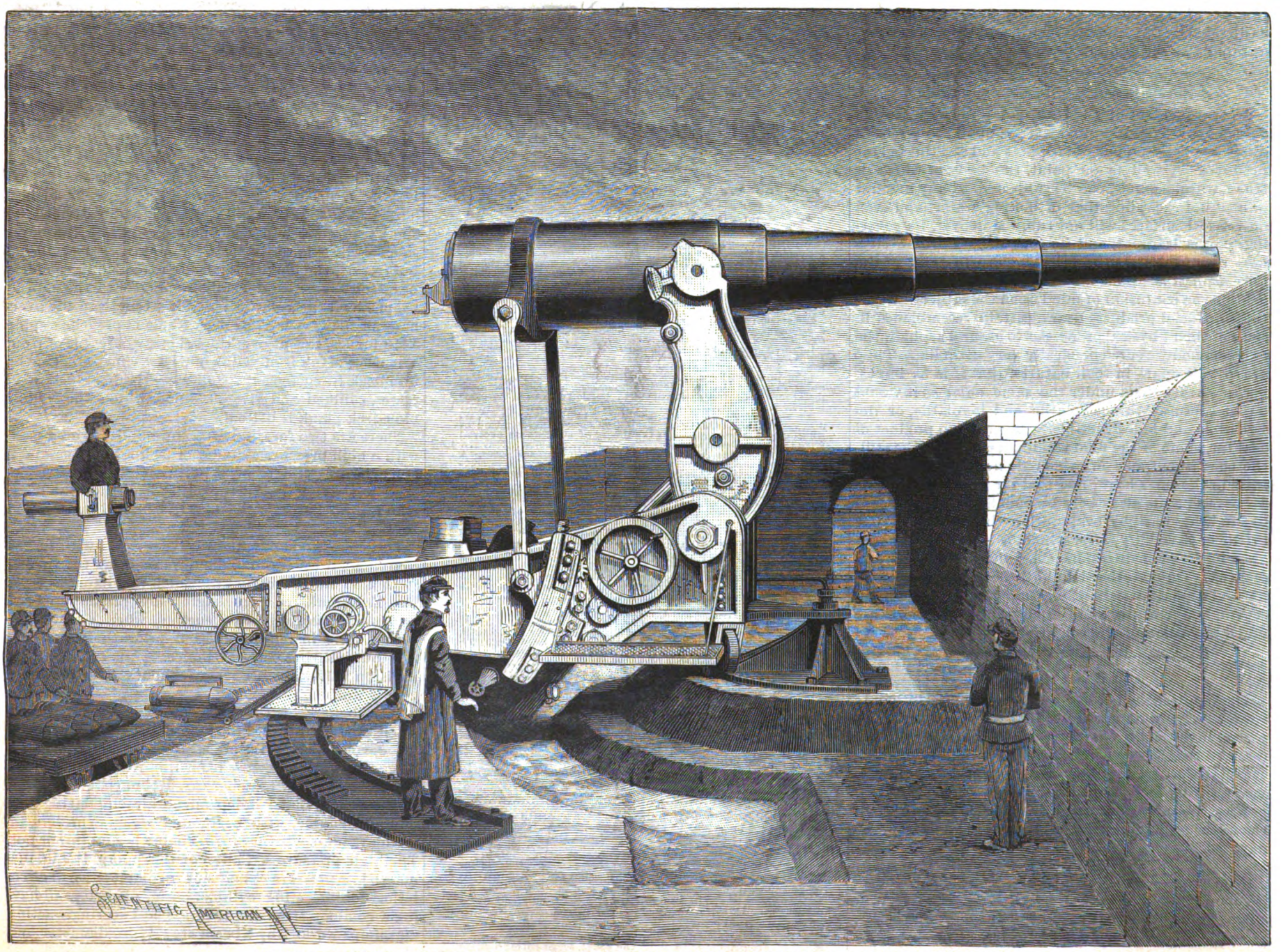
For several days during this month trials have been made on the parapets of the old fortifications at Sandy Hook of a new disappearing gun carriage, the first of its kind ever built in this country for use with large guns. Our illustrations represent the gun upon this carriage in firing position, and as it is moved back and lowered behind the battlements after firing. The gun is one of the new all-steel breech-loading rifles, and in its backward movement it is lowered eight feet, thus bringing it out of the direct range of an enemy's fire while being loaded and prepared for the next discharge. The trials thus far are said to have been eminently satisfactory to the United States army officers in charge, and the designer and inventor of the carriage, Mr. H. A. Spiller, of the South Boston Iron Works, is reported to have only a few slight changes to suggest to thoroughly perfect the practical working of the carriage in all its parts.

The first test was made December 4, a powder charge of 170 pounds being then used in the gun, and since that time further trials have been made with steadily increasing charges, almost the full ordnance charge of 250 pounds having been of late employed. The full charge is stipulated to be such as will give to a projectile weighing 575 pounds an initial velocity of 1,975 feet per second. Steel of domestic manufacture is used exclusively in the carriage and its operation is automatic throughout, the great gun appearing to come to firing position with as little trouble as the army soldier experiences in bringing up his musket to take aim, while, after firing, the recoil is checked so smoothly that the gun settles down behind the rampart without the slightest shock. The carriage weighs, complete, fifty-five tons. Its slide is pivoted well in front, in order that it may be traversed to a position parallel with and close to the parapet and bomb-proof, for greater security in loading, while it permits of motion for firing through a horizontal angle of 120 deg. The trunnions of the gun are mounted on the upper ends of two strong elevating levers, the lower ends of which are pivoted to the slide, and the gun is raised to firing position by means of compressed air acting on a piston working in a cylinder beneath. The piston rod is connected to the elevating levers by a cross-head, on each end of which are friction rollers working in elongated bearings in the levers, whereby the arc motion of the latter permits a rectilinear motion of the cross-head. Saddles fit over flanges on the slide to give direction to the cross-head and additional support to the gun when in the firing position.

The compressed air for the cylinder is designed to be supplied ordinarily by an engine working an air compressor, but a hand pump



THE GUN LOWERED FOR LOADING.



TESTING THE PNEUMATIC DISAPPEARING GUN CARRIAGE AT SANDY HOOK.

capable of doing the work in drill practice is also provided. The compressed air is supplied to the cylinder from the receiver, when the gun is in lowered position, at a pressure of 1,100 pounds to the square inch, and in raising the gun the pressure in the cylinder and receiver is reduced to 325 pounds to the inch. As the gun falls back in the recoil the air in the receiver is again compressed, the air then acting as a cushion to take up the force of the recoil, while the air pressure in the receiver is so well kept up in this way as not to need renewing for considerable periods at a time. A by-pass valve operated by a handwheel admits the air to the underside of the piston when the gun is to be raised, and side buffers assist in supporting the gun when it is down.

To train and elevate or depress the gun, a small reversible air engine is employed, located in a protected position under the gun, and provided with a follow-up stop motion valve controlled by a hand wheel, the compressed air being supplied from the receiver. The slide is traversed by beveled gears engaging in a rack, and worm gears connected with a cross-shaft which gears to the crank shaft of the engine. The elevation or depression of the gun is effected by a rod extending from near its breech to an adjustable connection with the rack, the rod working in line with the elevating levers after the manner of pivoted parallel rulers. The required adjustment of the rod upon the rack to give any desired elevation or depression of the gun is readily calculated, and can be easily effected.

In addition to its use in raising and lowering and training the gun, compressed air is also employed to assist in the loading. Upon a carriage beneath the breech, when the gun is in lowered position, rests the projectile, which weighs 575 pounds, but on the opening of the proper valve the carriage rises to a convenient position for pushing the projectile into the open breech, and this work is then performed by a pneumatic rammer, shown in the illustration. In a similar manner the powder is elevated and forced home in the rear of the projectile, the full charge being 250 pounds.

Quite a number of pneumatic and hydraulic disappearing gun carriages of various patterns have been built and experimented with in Europe, but all of them, so far as they have been tried, have failed to come up to the practical service standard which the officials of our ordnance department have sought to attain. The carriage now being tried was built by the Pneumatic Gun Carriage and Power Company, of Washington, and after the preliminary rounds, to test the working and adjustment of the several parts, ten rounds of full service charges are to be fired in the gun, as directed by the ordnance board, and ten more rounds as rapidly as the gun can be served.

Natural and Artificial Asphalts.

A correspondent of the *Railroad and Engineering Journal* takes occasion to lay stress upon the essential difference between natural asphalt and certain coal tar products. A well made paint, the body of which is true natural asphalt, can be subjected to any amount of heat not exceeding that of boiling water, and even on vertical surfaces will not run. Moreover, its covering power is great, and its toughness and adhesiveness remarkably enduring. The use in trade of the term asphalt as applied to certain coal tar products has led to some confusion of mind upon the subject. While these artificial products bear a certain resemblance in some of their physical properties to natural asphalt, the two commodities are chemically very dissimilar. They are so wide apart in their natures, that it is as improper to classify them under the same name as it would be to confuse "things volatile and involatile, or destructible and indestructible." There is no product of coal tar, short of the final residuum of coke in the still, the constituent oils of which do not gradually volatilize in the sun's heat; and coal tar products suitable for use as paints also easily become fluid when exposed to sun heat, until by evaporation they become so far brittle as to solidify, after which, a little further progress in the same direction causes them to perish and scale off. On the other hand, the constituent oils of natural asphalt are absolutely non-volatile at the highest sun temperature, and the material does not oxidize under any atmospheric conditions.

Invest Wisely.

The remittance of $3 for one year's subscription to the SCIENTIFIC AMERICAN for the coming year will be a good investment, but there is one that will pay better, and that is to send $7 and receive both the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT during 1892. With the weekly receipt of the two papers, the subscriber will have placed before him all the scientific, engineering, and mechanical news of the day.

CELLULOSE—made of the ground fiber of cocoanut—is coming into favor as buoyant inside armor for war ships. When penetrated by a shot the hole soon closes, so as to practically exclude the water. Our new cruiser, No. 9, will have this improvement.

Scientific American.

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NEW YORK, SATURDAY, DECEMBER 26, 1891.

Contents.

(Illustrated articles are marked with an asterisk.)

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For the Week Ending December 26, 1891.

Price 10 cents. For sale by all newsdealers.

THE NEW STEAM FERRY BOAT BREMEN.

It is gratifying to note that the spirit of improvement which prevails among the builders of ocean steamers extends also to river and ferry boats. The latter are among the most important of vessels, as the lives and safety of thousands of people are dependent upon their proper construction and management.

In 1888 we printed an illustrated article describing the Bergen, of the Hoboken Ferry Co., this city, the first of the new style of double screw ferry boats. This use of a screw at each end of the boat, driven by a common shaft, proved so satisfactory that the John McCullough was built for the Erie ferries, and the Cincinnati was built by the Pennsylvania R.R. Co. The owners of the Bergen, gratified by her success, have now built two new vessels of the same general style, the Bremen, just completed, and the Hamburg, which will soon be placed in commission. There will then be five screw ferry boats on the Hudson River at New York, representing the four different kinds of engines, all of them applying the power in the same manner as the Bergen.

The Bremen has an upper cabin deck, three large cabins, excellent speed, and is easily handled.

The main deck is divided in the usual way, a cabin on either side, with space between for vehicles and teams. All the machinery is below deck. The lower cabins are 156 ft. between entrances, with a mean breadth of 14 ft. and are 12 ft. 16 in. high. The women's cabin is finished in natural oak, with salmon color panels ornamented with gold. The men's cabin is in antique oak, with decorations to harmonize. The seats, of mahogany throughout the boat, number 464. A marked feature of each of the three cabins is the uninterrupted view from end to end, the graceful curve of the lines not being broken by the old-time paddle boxes. The upper cabin is an unobstructed saloon, 97 ft. long, 36 ft. wide and 10 ft. high, surrounded by a hood deck averaging seven feet in width and eight feet in height. The boat is lighted by gas, and heated by the Sturtevant system of forced circulation, renewing the air every five minutes, and the temperature is regulated by electro-thermostats.

The hull was built by T. S. Marvel & Co., Newburg, N. Y. The material is mild steel throughout. The dimensions are: Length of L. W. L., 317 feet; length over all, 322 feet; beam L. W. L., 35 feet; beam over guards, 62 feet; draught loaded, 11 feet; depth of hold, 17 feet; displacement, L. W. L., 900 tons.

The frames are 21 inches apart. Every third frame is a belt, except those in the engine and boiler compartments, where every frame is a belt. The keel is of the plate pattern, ⅞ inch thick and 24 inches deep, against which the frames butt on either side. A steel rider plate ⅝ inch thick and 30 inches wide is placed on top of the keel, and floor plates extend the entire length of the vessel. There are three main thwartship bulkheads, one amidship and the others about 40 feet from either end. Between the latter extend longitudinal bulkheads on each side of the vessel, leaving a mean space between them of 23 inches. These longitudinal bulkheads are again divided by short transverse bulkheads extending from the outer sides to the skin of the boat. Forward of the collision bulkheads, the longitudinals are extended in the form of a Howe truss, and being prolonged to the fantail beams, lend the greatest possible strength to the overhang of the vessel. The deck frame is of yellow pine 5 × 8 inches, except over the boilers, where it is of iron. The deck plank is of yellow pine 3 × 5 inches. On the iron deck frame over the boiler are laid ¼ inch steel plates, caulked and riveted, upon which the yellow pine deck plank is bolted.

There are two fore and aft compound engines, each with a high pressure cylinder of 20 in. diameter and a low pressure cylinder of 36 in., with a common stroke of 28 in., driving a shaft the entire length of the boat, with a propeller at each end, 8 ft. 6 in. in diameter, and 11 ft. pitch.

The shaft is composed of twelve sections with forged couplings; it is 9 in. in diameter, excepting the thrust, stern and crank sections, of which the diameter is 9½ in. The cranks of each engine are placed opposite each other, and the two engines, when coupled together, have in relation to each other their cranks at 90°, thus insuring perfect balance.

Piston valves are used throughout. The reversing gear is worked by steam.

Two boilers of the gunboat type supply steam. Their length is 21 ft., diameter 9 ft., grate area 91 sq. ft., developing an initial steam pressure of 125 lb. Engines and boilers are from the North River Iron Works of W. & A. Fletcher Co., Hoboken, N. J.

There is a Blake independent air circulating and pumping engine, with compound steam cylinders, insuring vacuum whether main engine is running or not. The high pressure cylinder of the pump is 7 in. diameter, low pressure cylinder 14 in. diameter, and circulating double-acting cylinder 17 in. diameter, all having a common stroke of 16 in. The two single-acting air pumps worked by a beam are 17½ in. diameter and 14 in. stroke.

The Bremen made her trial trip Oct. 31. Prof. J E. Denton, of Stevens Institute, conducted the tests of engines and boilers. On this occasion she made 123¾ miles with a steam pressure of 98 lb.; the engines being linked up 7 in., which cut off 9 in. in the cylinders, making 115½ revolutions per minute and developing 783 horse power. By test the engine has developed with 120 lb. steam and full link 1,448 horse power, but she will do her work with 900 horse power.

The plans were drawn by Col. E. A. Stevens and Capt. C. Woolsey, no other engineers having been employed.

New Edison Station.

The station of the Edison Electric Illuminating Co. now being built at the corner of Pearl and Elm Streets, this city, comprises many ideas which are entirely new in this field. Its capacity will be 30,000 h. p., the engines being of the vertical four-crank quadruple expansion type, with an initial pressure of from 210 to 220 pounds. These engines, it is said, will be of 5,000 h. p. each. A model 1,000 h. p. engine of the same type is being built by the Dixon Company for the Twenty-sixth Street Edison station. This engine occupies only 92 square feet of floor space, exclusive of the overhang of the shaft.

The boilers of the new station will be of the water tube type and will probably be internally fired. This latter point, however, has not been definitely settled. The system for collecting the radiant heat and returning it to the furnace is peculiar to this station. The doors and windows will be kept closed, and a constant supply of fresh air forced into the building at its lowest level. This air during its passage upward accumulates heat from engines, machinery and piping, and then is made to flow over the boilers and through a piping gallery and an arrangement of pipes in the chimney flue, being finally discharged into the ash pits and over the grates in the proportion of 80 and 20 per cent, respectively, at a temperature of about 300 degrees.

The steam mains will be of copper and will be run in rows, no single pipe being larger than 8 inches in diameter. Each pipe will be wound with steel wire for its entire length and corrugated into the flanges, no brazed joints being used.

This system, which we have only briefly touched upon, is the result of the deep study and extended observation of Mr. John Van Vleck, chief electrician of the Edison Electric Illuminating Co., of New York, who promises to reduce the consumption of coal to one pound per h. p. per hour. This, if accomplished, will result in a saving for this one station of the interest on nearly a million dollars. We are indebted to Mr. Van Vleck for these very interesting details.—*Elec. Engineer.*

Luminous Paints in all Colors.

A German contemporary gives the following series of receipts for these paints, which may prove useful. All the above paints can be used in the manufacture of colored papers, etc., if the varnish is altogether omitted, and the dry mixtures are ground to a paste with water. The luminous paints can also be used as wax colors for painting on glass and similar objects, by adding, instead of the varnish, ten per cent more of Japanese wax and one-fourth the quantity of the latter of olive oil. The wax colors prepared in this way may also be used for painting upon porcelain, and are then carefully burned without access of air. Paintings of this kind can also be treated with water glass. For orange luminous paint, 46 parts varnish are mixed with 17·5 parts prepared barium sulphate, 1 part prepared Indian yellow, 1·5 parts prepared madder lake, and 38 parts luminous calcium sulphide. For yellow luminous paint, 48 parts varnish are mixed with 10 parts barium sulphate, 8 parts barium chromate, and 34 parts luminous calcium sulphide. For green luminous paint, 48 parts varnish are mixed with 10 parts prepared barium sulphate, 8 parts barium chromium oxide green, and 34 parts luminous calcium sulphide. A blue luminous paint is prepared from 42 parts varnish, 10·2 parts prepared barium sulphate, 6·4 parts ultramarine blue, 5·4 parts cobalt blue, and 46 parts luminous calcium sulphide. A violet luminous paint is made from 42 parts varnish, 10·2 parts prepared barium sulphate, 2 8 parts ultramarine violet, 9 parts cobaltous arsenate, and 36 parts luminous calcium sulphide. For gray luminous paint, 45 parts of the varnish are mixed with 6 parts prepared barium sulphate, 6 parts prepared calcium carbonate, 0·5 part ultramarine blue, 6·5 parts gray zinc sulphide. A yellowish brown luminous paint is obtained from 48 parts varnish, 10 parts precipitated barium sulphate, 8 parts anripigment, and 34 parts luminous calcium sulphide.

Luminous colors for artists' are prepared by using pure East India poppy oil in the same quantity instead of the varnish, and taking particular pains to grind the materials as fine as possible. For luminous oil color paints, equal quantities of pure linseed oil are used in place of the varnish. The linseed oil must be cold-pressed and thickened by heat.—*Building World.*

Towers and Restaurants at the Columbian Exposition.

Permission has been granted to erect five observation towers on the grounds. So says the *American Architect.* They will be 250 feet high, and will have elevators running to the different buildings. At the base the space inclosed will be over 100 feet square, and the plan is to use this for a restaurant. The company has decided to erect one at the head of Sixty-third Street, which will be completed early next year. A passage for temporary use will connect this with the region beyond the fair grounds, so those desiring to watch operations before the opening of the fair will be able to do so.

The Columbian Tower Company, it is said, has also nearly completed arrangements to build a tripod tower near Fifty-seventh Street and Stoney Island Avenue. It will cost, so report goes, $650,000. The first landing will be 500 feet from the ground, with double pavilions, one 20 feet above the other, each suitable for a café. Six electric elevators will run from the ground to the first landing. The second landing will be 900 feet above the ground, the third 1,200 feet, and the fourth 1,400 feet. The top landing will have two sky parlors, one 10 feet above the other. Three electric elevators will run between the first and top landings. The floor spaces of the sky parlors will be about 800 square feet each. The wigwam at the base, 800 and more feet on each side, is to be fitted up with cafés and booths after the different styles and customs of foreign countries. But when all this much has been said, we may add that we have become a little skeptical on the tower subject, as well as on the subject of Oriental streets, scenes, bazars, etc.

One interesting feature of the fair will be its restaurants, and the plans for them have just been completed. The feeding of the vast crowd that will assemble on the grounds is no small part in the whole colossal undertaking. There will be 115 dining rooms, 27 restaurants, 17 complete hotel kitchens, and 1,000 cooks and scullions. It has been estimated that if the dining rooms were thrown into one great hall it would cover 5 acres and 6,500 people can sit down at the same time. The restaurants will, of course, be placed in the different buildings. So, wherever one happens to be at meal times, a place will not be far off for refreshing the inner man. There will be 16 restaurants on the main floor of the Manufactures Building, located under the galleries and just within the loggias; on the east and west sides of the building. Entrance to the restaurants will be made from the inside as well as from without, and in pleasant weather lunch will be served in the corridors. These dining rooms are each 100 × 22 feet. They are supplied by 8 kitchens on the main floor, with store room and dining room for servants in the basement. In the galleries are to be 76 private dining rooms, connected with the kitchens and restaurants by dumb waiters.

In the Mines Building there will be one restaurant, 40 × 162 feet, and five dining rooms 40 × 20. The restaurants in the Electricity Building will, so far as situation is concerned, be the most attractive on the grounds. They will occupy the big bays at the north end of the building, and will overlook the lagoon and the island.

Machinery Hall will have four restaurants, with a seating capacity for nearly 500 guests, and private dining rooms seating over 300.

The Horticultural Building will have two restaurants, one at each end of the pavilion. These rooms are 100 feet square, and will seat 1,000 people.

At the restaurant in the Fishery Building, which will seat 200 people, nothing but fish and oysters can be obtained. Equally in keeping with the Transportation Building will be a typical American railway lunch counter, where 200 hungry mortals can be satisfied at once. The cow will do her utmost to feed the hungry in the Dairy Building, the lunch there being restricted chiefly to her products.

Remarkable Fire Escape Trial.

A Chicago correspondent of the *American Architect* writes as follows: The copestone of the great Masonic Temple here in our city has been laid. Just a year has elapsed in the construction of the twenty stories which compose the building. The ceremony, without doubt, was interesting to the brotherhood of white-plumed knights, but to the world at large a much more interesting performance was one which took place a day later in the same structure, when a successful experiment was tried by the inventor of a pocket fire escape. The stairs in the building are not yet completed, and it was a tremendous operation: the climb to the top story enabled the spectators to fully realize the height from which the test was to be made. The machine which played the principal part in the experiment is a simple device. It consists of a metallic tape one-quarter of an inch wide and a thirty-second of an inch thick, running on a steel reel which is fastened to a web belt that passes around the waist. The reel is provided with a brake whereby the person using it can control the speed of his descent. There is also an automatic brake to keep a required tension on the tape and thus prevent a sudden drop. The end of the tape is provided with a thumb screw which can be fastened to the window sill or any object in the room. The machine in appearance is like a fisherman's reel and is about twice the size of a spool of thread. The experiment was entirely successful, but, to say the least, decidedly ghastly at the commencement, when, after having placed the thumb screw and adjusted the webbing belt, the inventor stepped off apparently into space from the twentieth story. He at first descended slowly, then faster and faster till it seemed as if he must have lost control over the little machine, the slender tape of which could scarcely be seen, and at any time looked no larger than an ordinary cord. At the tenth story the man stopped suddenly, gave the crowd beneath time to compose itself, and then made another run to the seventh story, from which he descended, running and stopping by turns till he reached the scaffolding, where he took three men on to the line with him and dropped to the ground with them. If the invention is what it appears to be, it is a very ingenious one, and one which will be of great use to mankind.

Electro-plating with Aluminum.

The essential features of a new system of electro-plating with aluminum are as follows:

A solution of ammonia alum in warm water is prepared, containing 20 per cent of alum. To this is added a solution containing about the same quantity of pearl-ash and a little ammonium carbonate. The mixture results in effervescence, and in the deposition of a precipitate. The latter is filtered off and well washed with water.

A second solution of ammonia alum, containing 16 per cent of alum and 8 per cent of pure potassium cyanide, is now prepared warm and poured over the precipitate previously obtained, the mixture being then boiled for 30 minutes in a closed iron vessel, jacketed to insure uniformity of heating.

The proportions suitable in the above solutions are as follows:

First Alum Solution.

Ammonia alum	2 kilogrammes.
Warm water	10 "

Pearlash Solution.

Pearlash	2 kilogrammes.
Warm water	10 "
Ammonium carbonate	8 to 10 grammes.

Second Alum Solution.

Ammonia alum	4 kilogrammes.
Warm water	25 "
Potassium cyanide	2 "

At this stage about 20 kilogrammes of water are added, and about 2 kilogrammes more of potassium cyanide, and the whole is kept on the boil for about a quarter of an hour.

The liquid is then filtered from the precipitate, and is now ready for use in the electrolytic bath.

The anodes are perforated or slotted plates of aluminum, arranged so that that they can be conveniently raised or lowered. The cathodes receive the deposit.

The anodes and the cathodes are connected respectively to the terminals of a battery or of a dynamo machine, and the current is thus transmitted through the bath, which is kept throughout the operation at a temperature of about 80° to 150° Fah.

By attaching to the aluminum anode pieces of other metals, *e. g.*, gold, silver, nickel, copper, etc., the tint of the deposited metal can be somewhat varied. When the deposit presents a gray tint, it is brightened by dipping the plated article in a solution of caustic soda, which has also the effect of impeding oxidation.—*Electrical Review.*

Artificial Stone.

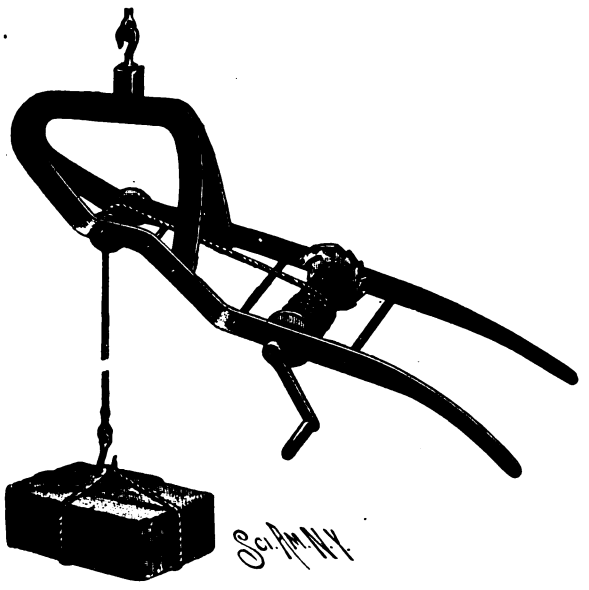
Ten parts of silicic acid, powdered and freed from impurities, are mixed with 90 parts of water and 100 of quicklime, all by weight. One hundred parts of the product are mixed with 100 parts of sand and 5 parts of magnesia or fluorspar, and the mass moulded as desired. The articles are allowed to dry for 12 to 24 hours, and subjected to steam pressure under 10 atmospheres pressure for 48 to 72 hours, after which they are treated with boiling saturated calcium chloride solution at a pressure of 10 atmospheres for 6 to 12 hours. They may then be dried by air or the circulation of steam. Marble, magnesia, magnesium limestone, etc., may be substituted for the sand. The stones thus formed are said to resemble marble, sandstone, granite, etc., closely, to be fireproof, and to resist the action of the weather as well as natural stones.—*C. George, Berlin, Germany.*

A Suggestion to Employers and Fathers.

What better Christmas present or New Year's gift can an employer give a faithful superintendent, foreman, or workman, or a father his son, than a copy of the "Scientific American Cyclopedia of Receipts and Queries," just published by Munn & Co.? Certainly nothing could be more useful, or likely to be better appreciated than a copy of this book. It may be had at any book store or will be sent from this office by mail on receipt of price, $5.

A CONVENIENT HOISTING APPARATUS.

The improvement shown in the picture is designed to displace the usual endless chain employed for hoisting heavy articles into a building, placing ice in a storage house, etc. It has been patented by Mr.

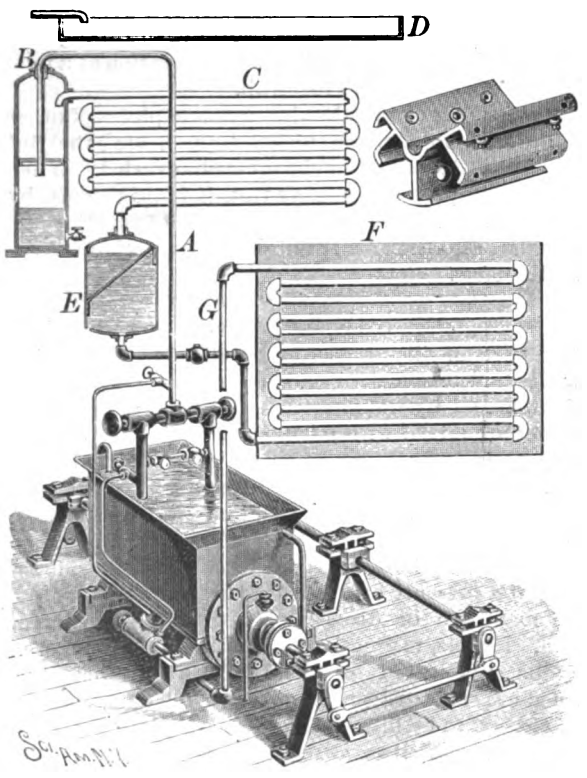


KAYE'S HOISTING APPARATUS.

Samuel Kaye, Yazoo City, Miss. The frame may be of metal or wood, its sides suitably connected by tie rods, and the windlass has a hand crank at one end and a ratchet wheel engaged by a pawl at the other end, the hoisting rope attached to the windlass passing over a pulley or sheave journaled in the forward part of the frame. Swiveled in a bail at the top is a hook, for conveniently securing the hoist to any suitable elevated support, such as a hanging link at the top of a window frame or door. When the apparatus is out of use the handles hang down, but when the hoisting rope is attached to an article to be raised, the handles swing up to a convenient position to be grasped and held by the operator as he turns the crank handle. The swiveled hook permits the complete revolution of the frame, and when the weights of the loads to be lifted make it desirable the point of connection of the bail with the frame may be changed, there being a series of perforations in the top portion of the frame to receive the pivot of the bail.

AN ICE MACHINE IN WHICH A CONTINUOUS CYCLE OF WORK IS EFFECTED.

The illustration represents an ice machine designed to be run with comparatively small power, without leakage of gas. It has been patented by Messrs. Frank L. Fonda, Robert C. Roach, and Walter H. Underwood, of Hutchinson, Kansas. The operating shaft is journaled in stuffing boxes in the ends of a cylinder within which is secured a spider, shown in the small view, there being a fixed wing on the shaft within the cylinder, and the shaft being connected by crank arms and links with the main driving shaft, whereby



AN IMPROVED ICE MACHINE.

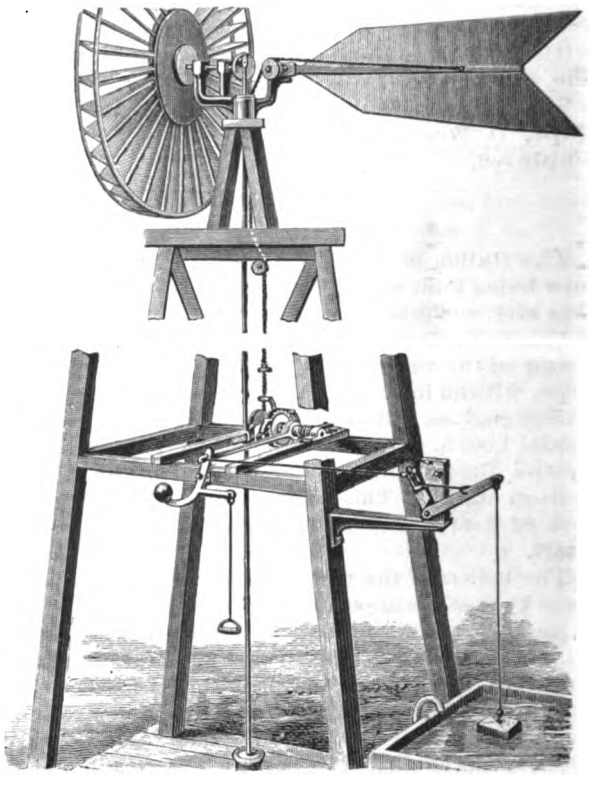
an oscillating movement is given to the cylinder shaft and its wing, to compress gas within the cylinder in the space above the spider. The several arms of the spider extend from one end of the cylinder to the other and form longitudinal chambers, in the top one of which the wing oscillates, moving close to the top surfaces of the spider arms on each side, to fully expel all the contents of the chamber. The two bottom chambers are connected by apertures in the web of the spider to form a single suction chamber, while the chambers immediately above, one on each side, are discharge chambers for the compressed fluid, the suction chambers being connected with the compression chamber by suction valves, and the discharge chambers being connected with it by discharge valves. To keep the compression chamber cool it is surmounted by an open tank supplied with water from a suitable source and having an overflow pipe to carry off the surplus. Into one of the bottom chambers leads a fluid inlet pipe, with a valve to regulate the amount of fluid sucked in, and from the discharge chambers at the top two pipes lead upward through the water in the reservoir to a transverse valved pipe, from which extends upward the pipe A, discharging into an oil trap B, in which is a horizontal strainer or sieve, the lower compartment receiving the oil, and having a draw-off cock. From the upper compartment a pipe extends to the coil C, forming a condenser, in connection with a spraying tank D above. The other end of the coil connects with a filter E, in which a diagonally arranged strainer filled with filtering material is designed to purify the fluid or freezing mixture, the pipe from the bottom of the filter leading to a brine tank, F, in which the brine is cooled in the usual manner. The pipe G leads from the brine tank to the suction pipe, whereby the used gas is drawn back into the cylinder to be again compressed in the same manner as before, the operation being continuous and the fluid being used over and over again. The construction of the entire machine is designed to be very durable and simple. Further particulars in regard to it may be obtained by addressing R. C. Roach, Secretary, No. 16 First Avenue, West, Hutchinson, Kansas.

Le Dansk.

Under the name of "Le Dansk," there is being introduced into England, so says *Industries*, by M. Auguste Pellerin, of Paris, a butter substitute which appears to possess the merit of being wholesome as well as economical. Its manufacture has just been begun at large works which have been erected at Southampton, and which were recently opened. "Le Dansk" is already known in the trade, having hitherto been produced at M. Pellerin's factory in Paris. Its basis is the fat obtained from freshly slaughtered cattle, which is first converted into oleomargarine, and afterward treated and made into "Le Dansk." The process consists in first reducing the fat to small pieces of uniform size in special machines, and then melting it at a temperature of 50° C. It is then transferred in a liquefied condition to water-jacketed tanks, in which it is kept for about two hours and a half at the same temperature. After this it is drawn off into shallow vessels, where it remains for thirty-six hours at a temperature of 32° C., during which time it assumes a crystalline condition. The product now consists of oleo and stearine, and these are separated by means of hydraulic presses, the oleo being pressed out, and the stearine remaining in the press cloths. The oleo is then placed in churns with certain proportions of new milk and oil and some pure butter, and the ingredients are churned for fifty minutes. The contents of the churns are then removed and cooled in iced water, and the margarine is afterward placed in mixing machines. Here it is salted and thoroughly incorporated, and afterward packed in boxes and baskets for the trade. The cooling apparatus and the general machinery are driven by a horizontal compound engine of 80 h. p., which also drives a dynamo, the works being lighted by electricity. The factory is well laid out, and every precaution appears to have been taken to insure the absolute wholesomeness of the product, scrupulous cleanliness being everywhere observable.

AN AUTOMATIC WINDMILL REGULATOR.

The regulator shown in position in the accompanying illustration is intended to be attached to any windmill used for pumping purposes, to regulate the supply of water in the tank, automatically throwing the wheel out of the wind when the water reaches a certain height, and throwing it into the wind again when the water has been lowered a few inches. The improvement has been patented by Mr. E. B. Wilson, a farmer living near Central City, Neb., and has been for some time successfully used by him on his own farm. The wheel shaft has a crank pulley operating the pump rod in the usual way, and a cable secured to the vane runs downward to a pulley on a shaft mounted in crossbars of the main frame. On this shaft is loosely mounted a ratchet wheel having an elongated hub with teeth at its outer edge, the wheel being held from moving longitudinally by a pin through the shaft entering opposite grooves in the hub, and being turned forward by a pawl pivoted to an arm, one end of which is pivoted on the shaft while the opposite end is secured to the pumping rod. On this arm is pivoted a bent rod having an eye at one end encircling the cable from the vane, the other end of the rod extending beneath the pawl. When the mill is thrown out of gear the cable moves downward, and a stop upon it strikes the eye and tilts the rod, raising the pawl so that it will not engage the ratchet wheel, and a sudden gust of wind starting the mill will not be likely to break any of the mechanism. A sleeve sliding on and turning with the shaft has teeth on its inner end to engage the teeth of the hub, the sleeve and the hub

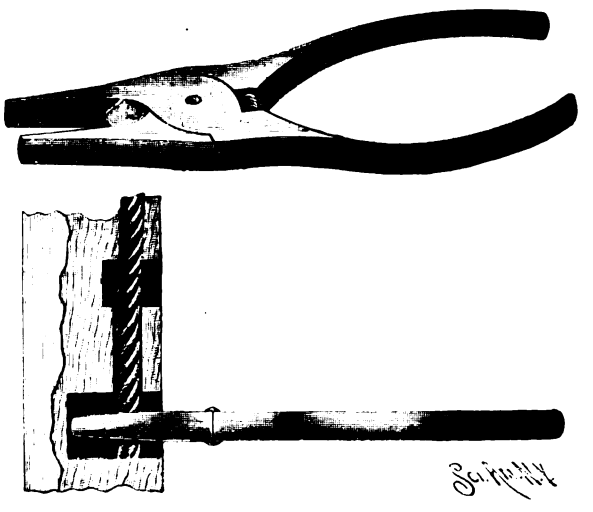


WILSON'S WINDMILL REGULATOR.

forming a clutch operated by a lever, the free end of which is connected by a wire with one arm of what is virtually a bell crank of novel construction, to permit a slight independent movement of its two arms, the other arm being connected by a wire with a float in the tank. The free end of the lever which operates the clutch is also connected with one arm of a bell crank whose other arm is connected with a depending wire terminating in a handle, whereby the regulator may be moved by hand if desired at any time. With the wheel in the wind and pump rod moving normally, the ratchet wheel is constantly moved, but without engaging the sleeve; when the float rises sufficiently, the bell crank is operated and a spring is released by which the sleeve is thrown into engagement with the hub of the ratchet wheel, and the cable is wound on its pulley to swing the vane or rudder out of the wind, thus stopping the mill. With the lowering of the water in the tank, the weight of the float again swings the bell crank to release the clutch and allow the rudder to swing back into the wind.

IMPROVED SASH CORD PLIERS.

A tool which can be easily and quickly handled to withdraw a sash cord from an opening in the sash into which it is inserted, for the purpose of knotting the cord or otherwise securing it to the sash, is shown in perspective and as applied in use in the accompanying engraving. It has been patented by Mr. Grafton H. Duvall, of Philadelphia. It consists of two members pivoted one upon the other, with their curved handle sections normally forced apart by a spring, maintaining the jaws, whose inner faces are roughened, some distance apart and parallel with each other.



DUVALL'S SASH CORD PLIERS.

Further information relative to this improvement may be obtained of Mr. Philip R. Wells, No. 4288 Frankford Avenue, Philadelphia, Pa.

THIS number closes the volume of the SCIENTIFIC AMERICAN. Present subscribers will oblige the publishers by signifying their intention of continuing the paper by remitting at once. New subscribers solicited.

AUTOMATIC DISTRIBUTERS OF BEVERAGES.

If there is any simple and practical means of suppressing the largest number of media between the producer and consumer, it is unquestionably the institution of those automatic fountains and popular bars that have been in operation for about a year in Paris and in some other large cities of France and foreign countries, and which we propose to describe to our readers.

In the automatic distributers of which we speak, and a specimen of which is shown in Fig. 1, it suffices to put a coin, say a five cent piece, in a slot, when a tube placed beneath the money box allows a small glass of malaga, a large glass of beer, etc., to flow. The apparatus operates with perfect regularity, and the quantity of liquid is always accurately measured, its volume varying with its nature. There are distributers of this kind that serve hot liquids (such as coffee) or iced ones. A series of different types is at present installed at the Exposition of Labor at the Palace of Industry. Our Parisian readers will there be able to observe the regularity with which these automatic apparatus operate. Several bars provided with them are installed in different parts of Paris. We give, in Fig. 2, a representation of one that is in operation at 32 Montmartre Street, where a great variety of liquors is automatically distributed.

Before describing in some detail the ingenious processes that have permitted of solving the problem from a mechanical point of view, it is not without interest to set forth the reciprocal advantages that such a combination offers to the two principal parties interested —the consumer and the producer. To the consumer, the automatic distributer offers the advantage of immediately delivering, for a moderate sum, and without any loss of time, an accurately measured quantity of a hot or cold beverage furnished directly by the producer. The latter, selling his merchandise directly, can deliver it at a very low but remunerative price, and, through the aid of the apparatus, with placards, circulars, etc., put at the consumer's disposal, can obtain the best of advertisements.

In fact, these automatic distributers of liquids already have, for natural enemies, all the manufacturers whose indifferent or unwholesome products cannot undergo the decisive test of a previous tasting. We cannot dwell upon the numerous applications to which the automatic distributers of liquids may be put outside of the simple establishments of consumption. In railway stations, public gardens, etc., it will be possible to utilize these apparatus, either with the charitable object in view of furnishing the poor with wholesome and strengthening beverages (such as milk, bouillon, etc.) at a low price, or with the simple motive of making a new product known and appreciated. The functions of these automatic distributers are extremely varied, and so their form and arrangement are likewise extremely varied, according as it is a question of distributing a liquid at the surrounding temperature—hot or cold—under pressure like beer, or easily fermentable like milk, etc. We shall consider, in the first place, the simplest case, that in which it is a question of distributing a non-fermentable liquid at the surrounding temperature and without pressure.

The type of automatic distributer that we have selected to illustrate our discription (Fig. 1) presents externally the appearance of two superposed kegs. The upper keg protects a glass bottle containing the supply of liquid. The lower keg conceals the entire mechanism. The total height of these two kegs is less than four feet. The mechanism is exceedingly simple and certain, for it utilizes the most constant and infallible force at our disposal—that of gravity.

The work produced by the fall of the coin from the slot into the pan effects the starting of the mechanism and the opening of the cock. The liquid on flowing into a reservoir makes the latter tilt, and this, at the same time that it closes the cock and stops the mechanism, causes the advance of a counter that verifies the number of drinks taken. The apparatus is then ready to operate anew.

The money is inserted through a rectangular slot, regulatable at will, according to the price to be obtained. Coins that are too large cannot pass through it, and those that are too small are thrown outside without causing the apparatus to operate, and thus notify the expectant consumer of his error or of his dishonesty. Coins of the proper size fall into a pan, A (Fig. 3), which tilts and starts the apparatus.

After the tilting, the coin falls into a lead-sealed box whence it is impossible to take it without breaking the seals. The balanced lever supporting the pan, A, frees, during its motion, through the aid of the cam, C, of the lever, D, and of the eccentric, E, the valve, F, that retains the liquid in the bottle. At this moment the liquid flows with a velocity that may be regulated once for all at the time of setting up the apparatus. The valve having been raised, the liquid begins to flow, and through the pipe, C, enters a small reservoir, forming a balance, whose fall is regulated by a counterpoise, P, mounted by a screw upon a lever arm, O P. Upon moving this counterpoise more or less from the axis, we modify at will the volume of the liquid delivered before the tilting that effects the stoppage of the apparatus and the closing of the cock that holds back the liquid. The tilting of the reservoir, H, occurs in two periods. In the first period, as soon as a small quantity of liquid has fallen into H, a motion takes place that causes the piece, L, to bear against the cam oscillating around the point, N, and mounted upon the lever, N O P. The second tilting takes place only when the increasing weight of the liquid in the reservoir, H, is great enough to lift the counterpoise, P. This tilting is regulated with great precision by the shifting of the counterpoise, P. The reservoir, H, then comes into the position shown by the dotted lines, the lever, Q, lifts the lever, D, turns the eccentric, E, and closes the valve, F, and this arrests the flow of the liquid. As soon as the reservoir is empty it rises and sets the measuring lever, M N O P, anew by turning back the cam, M, around the point, N, in order to allow of the passage of the curved piece, L. As the lever, D, during the second tilting motion, has set the cam, C, everything is ready for a new operation as soon as another coin, deposited by a customer, falls upon the pan, A.

This same apparatus is capable of serving for the discharge of quantities of liquids varying between two ounces (spirituous) and ten ounces (coffee). It is possible, moreover, through a modification of the dimensions of the reservoir and counterpoise, to discharge any volume whatever. The liquid falls into a porcelain-lined cast iron vessel terminating in a small bent tube beneath which the glass that is to receive it has been placed. It will be seen that, under such circumstances, the apparatus is always ready to serve a drink as long as anything remains in the bottle. The readings of the counter of drinks dispensed, moreover, are very useful for making known to the attendant, without opening the apparatus, whether or not the bottle needs to be refilled. It suffices to note the figure marked by the counter at the time of the last filling, the capacity of the bottle and the volume occupied by each drink. A very simple calculation then permits of determining what the counter will mark when the bottle is empty, and will render it possible to take the precaution to fill it anew before its exhaustion.

Such are the principal arrangements of the automatic distributer of liquids at the surrounding temperature. When the liquid is to be drawn hot or cold, it previously traverses a worm placed in a hot water bath or in a vessel filled with chopped ice. The simple passage through the spiral suffices to communicate to it the proper temperature, which latter is regulated by a cock placed upon the bottle and that allows the liquid to traverse the spiral with varying rapidity. Modifications upon which it does not appear necessary to dwell permit of distributing liquids under pressure (such as beer and gaseous beverages), with the same facility.—*La Nature*

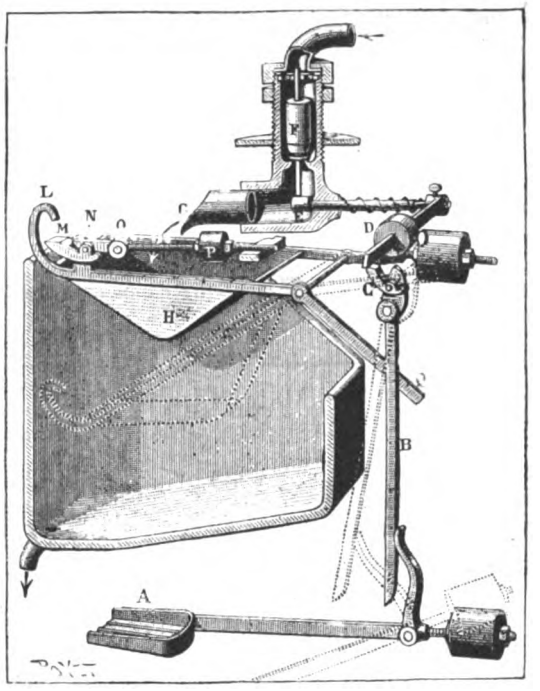


Fig. 3.—MECHANISM OF THE DISTRIBUTER REDUCED TO ITS ESSENTIAL PARTS, THE SUPPORTS AND AXES REMOVED.

A. The pan into which the coin drops. B. Starting lever of the valve. C. Starting cam. D. Lever for controlling the eccentric. E, that opens the valve, F. G. Outlet of the liquid. H. Tilting reservoir. L. Piece bearing against the lever that regulates the discharge. M. Cam mounted upon the lever N, and oscillating around O. P. Weight for regulating the volume of liquid discharged. Q. Lever that raises the lever D, which controls the eccentric E, for arresting the flow of the liquid.

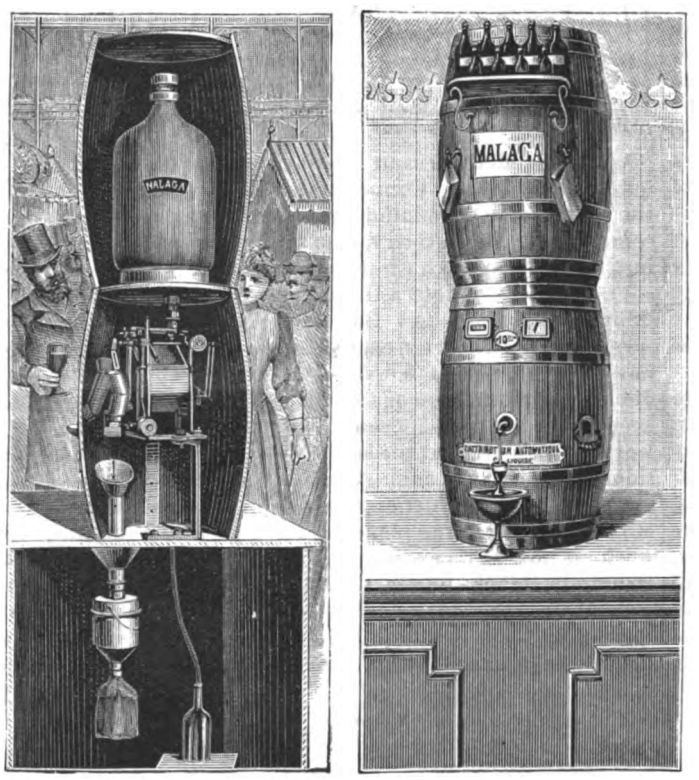


Fig. 1.—AUTOMATIC DISTRIBUTER OF MALAGA WINE.

Front view and section showing the interior of the apparatus.

Fig. 2.—GENERAL VIEW OF A BAR WITH AUTOMATIC DISTRIBUTERS.

Banana Flour.

We have received from Messrs. W. Keidel & Co., Durban, South Africa, a specimen of flour made from the banana fruit, which appears to be a useful article. The mode of preparation is not stated.

THE DREXEL INSTITUTE OF ART, SCIENCE, AND INDUSTRY.

By the generous action of one of Philadelphia's noble citizens a magnificent institution for industral learning has been established in that city; and on the 17th inst. the beautiful structure was the scene of dedicatory exercises of a highly interesting nature.

The institute was built and endowed by Anthony J. Drexel, head of the great banking firm of Drexel & Co., and its scope and objects as outlined by him "are the extension and improvement of industrial education as a means of opening better and wider avenues of employment to young men and women."

The building was erected at a cost of $600,000, and Mr. Drexel has endowed it with a fund of $1,000,000.

Mr. Chauncey M. Depew, of New York, made the dedicatory address. He was followed by Wayne MacVeagh, who presented, on behalf of Mr. Drexel, the deeds of trust conveying the building and endowment funds. Dr. James McAllister, president of the institute, responded.

The institute is located at Thirty-second and Chestnut Streets, West Philadelphia. The cost of the building and grounds was about $600,000. The building is in the style of the classic Renaissance, constructed of buff brick with terra cotta ornamentation, the base being of rock-faced granite. A richly decorated portal in Chestnut Street, 26 feet wide and 35 feet high, forms the principal entrance. This admits to a portico of colored marbles and paneled oak ceiling, which in turn opens into a spacious hall, the ceiling of which is supported by pillars of red Georgian marble. Beyond is a great central court, 65 feet square and the entire height of the building, and covered with a ceiling, the center of which is of stained glass. A double marble stairway leads to the upper floors and descends to the auditorium and the workshops in the basement. Broad galleries extend around the court on the second and third floors. These are supported and inclosed by arcades. From these galleries entrance is afforded to the classrooms, laboratories, and studios, all of which are lighted from without. The portico, entrance hall, and central court are wainscoted in marble; the arcades are faced with enameled bricks, and the dividing cornices are of terra cotta. The woodwork throughout the building is of polished oak.

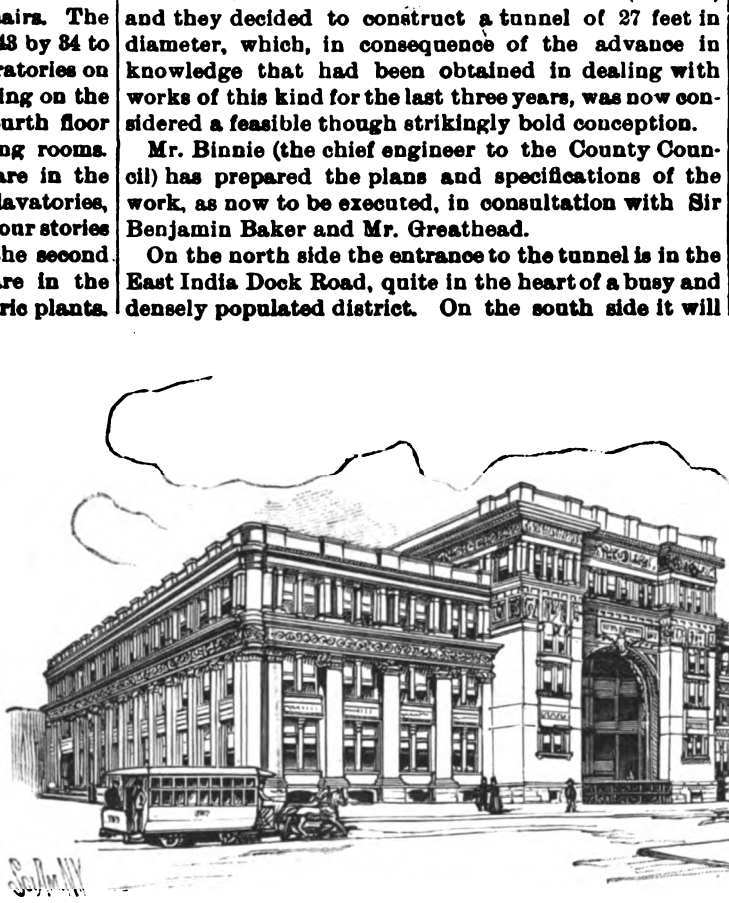
The offices, library and reading room are on the first floor. There is a lecture room, with a seating capacity for 250 students; the auditorium is capable of seating 1,500 persons. A grand organ occupies the space back of the stage at the eastern end. The seats in the auditorium consist of rows of upholstered arm chairs. The classrooms are commodious, averaging from 43 by 34 to 56 by 44 feet. There are three physical laboratories on the second floor, the chemical laboratory being on the third floor, and the gymnasium on the fourth floor front. These connect with bath and dressing rooms. The photographic studios and laboratory are in the rear on the fourth floor. Cloakrooms and lavatories, finished in marble and oak, are placed in all four stories of the building. The trustees' room is on the second floor. The shops for mechanical work are in the basement, as are also the steam and electric plants.

The object of the institute is the extension and improvement of industrial education as a means of opening better and wider avenues of employment to young men and women. The plan is comprehensive, the aim being to provide liberal means of culture for the masses by means of lectures, evening classes, library and museum. It is expected, however, that modifications will be made as the growth of the several departments and the experience gained in conducting them may require.

The work of the institute will be arranged under the following general divisions: 1, Art Department; 2, Scientific Department; 3, Department of Mechanic Arts; 4, Department of Domestic Economy; 5, Technical Department; 6, Business Department; 7, Department of Physical Training; 8, Normal Department for the Training of Teachers; 9, Department of Lectures and Evening Classes; 10, Library and Reading Room; 11, Museum.

Independent of the regular departments, students will have the option of taking such courses as they may elect and can advantageously pursue. Other departments will be added as the need or demand for them becomes apparent. A department of choral music will probably be instituted at an early day. A system of free scholarships will be established for the regular and special courses.

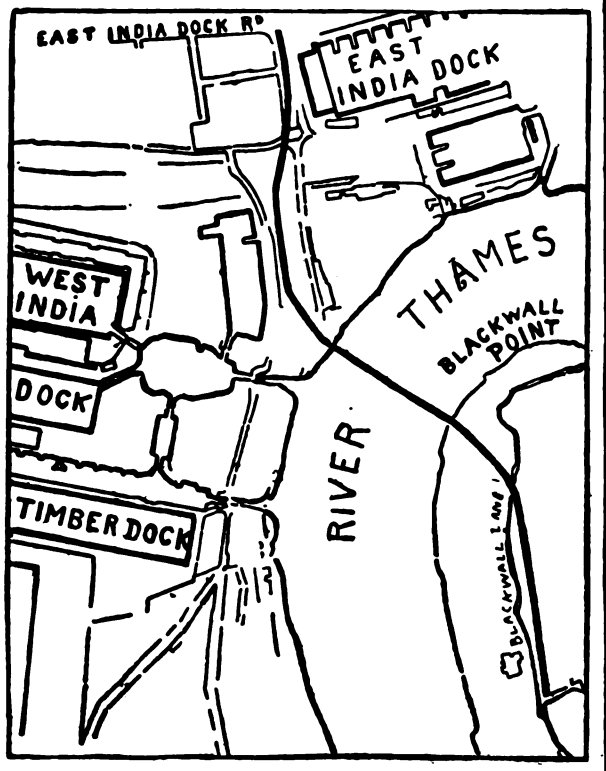
In order to guard against the abuse of the privileges of the institute, fees will be required, but the liberal endowment of $1,000,000 is designed to make the charges moderate, and all moneys received will be applied to the maintenance of the work of the institute. Deposits will be required to guard against loss through breakage in the laboratories. Students will be expected to supply text books, and those in the millinery and dressmaking classes will provide part of the materials used, but all tools and materials used in the workshops will be furnished by the institute.



THE DREXEL INSTITUTE OF ART SCIENCE AND INDUSTRY.

THE NEW TUNNEL UNDER THE THAMES.

The London County Council have at last signed a contract for the construction of the much-debated tunnel at Blackwall, and should there be no hitch, we may anticipate in three years the completion of a work which will be of incalculable value to that busy and populous portion of the metropolis which lies east of London Bridge.



When the Metropolitan Board of Works received its quietus, the County Council began *de novo* to consider the best means of communication across the river. They consulted Mr. Wolfe Barry, who recommended a bridge; but, after a thorough examination of all the pros and cons, they decided that a tunnel, as originally approved of by the Metropolitan Board of Works, would best meet the case if it were carried out in a modified form, and they decided to construct a tunnel of 27 feet in diameter, which, in consequence of the advance in knowledge that had been obtained in dealing with works of this kind for the last three years, was now considered a feasible though strikingly bold conception.

Mr. Binnie (the chief engineer to the County Council) has prepared the plans and specifications of the work, as now to be executed, in consultation with Sir Benjamin Baker and Mr. Greathead.

On the north side the entrance to the tunnel is in the East India Dock Road, quite in the heart of a busy and densely populated district. On the south side it will debouch on Greenwich Marshes, about a mile and a quarter from Greenwich Hospital. The heavy traffic from the docks will be able to reach Greenwich, Deptford, and the populous districts of South London by way of the tunnel, instead of making the circuit of London Bridge—a saving of at least ten miles. The gradient, of which so much has been made, will not be a serious obstacle. It is less than that of the roadway at St. Martin's Church, leading from the Grand Hotel to the corner of the National Gallery.

On each side there will be an open approach to the tunnel of about 800 yards, and the total length of the tunnel proper will be 4,464 feet, of which 1,212 feet is to be under the river. The exterior diameter of the tunnel is, as we have said, 27 feet and the interior 24 feet, and when we state that this exceeds by 5½ feet the largest tunnel ever attempted of this class, the uniqueness of the work will be appreciated. The tunnel under the Hudson, which is also being built by Messrs. Pearson, has a diameter of 19 feet 6 inches, and the Sarnia tunnel under the St. Clair River, which Sir Henry Tyler opened recently, is about 20 feet 6 inches. The work at Blackwall will give a roadway of 16 feet available for two lines of vehicular traffic and a footpath on each side of 3 feet. The tunnel being an exact circle, the roadway will be raised about a fourth from the bottom, leaving a headway of 17 feet 1½ inches. The space under the roadway is to be utilized for a subway, 4 feet wide by 4½ feet high, for drainage, lighting, and other purposes. For 3,698 feet the tunnel will be constructed of iron, with a lining of white glazed bricks; 761 feet of "cut and cover" will be of concrete and brick, and 1,645 feet of "open cut" will be of the same material. The iron will be 2 inches thick and the brick lining 15 inches. Fourteen segments and a keypiece will make up a ring 2½ feet wide. The work of tunneling will be carried out by shields, having novel safety faces and other special appliances, on lines suggested by Sir Benjamin Baker. This work will undoubtedly be the most difficult of the kind ever attempted, as the bore will come within 6 feet of the bed of the river, and nothing will intervene between the shield and the 45 feet of water at high tide but 6 feet of gravel. The Severn and Mersey tunnels were built in rock, and in their case the work was done on known and tried methods, but at Blackwall we have uite other conditions, and without the shield system it would be a simple impossibility to do the work. It will be necessary to use compressed air for at least two-thirds of the entire length of the tunnel, and care will in consequence have to be exercised in picking the men, for while some can work with perfect impunity under a pressure of 30 pounds to 40 pounds, others would be maimed for life. Operations will begin at several points, the shafts which have to be sunk being utilized for this purpose. Three of these shafts, about 60 feet in diameter, will remain permanently as stairways for foot passengers and the fourth for ventilation.

The Parliamentary estimate for the original scheme was £1,124,000, whereas the contract has now been let for £871,000 for a tunnel to answer practically the purposes of the three tunnels originally proposed to be built. As compared with former works the cost is extremely moderate. The old Thames Tunnel was built for about £1,200 per yard, while the Blackwall Tunnel will work out at about one-third of that amount.—*Pall Mall Budget.*

Adaptation of Photography to Printing in Colors.

The *Petit Journal*, of Paris, has just put out a new weekly publication with colored illustrations. It may be of interest to show how photography has been used in obtaining the typographic printing blocks. The attention of the great printing establishments of the whole world has been directed to the appearance of a rotary printing machine, which, receiving the white paper in rolls, converts it into a journal printed in four colors, and this at a rate of 12,000 copies in an hour. This result is due to the ingenuity of the celebrated engineer Marinoni, who for the adjustment of the different monochromes has had recourse to photography. The colored picture of the artist is photographed by Messrs. Vallot Bros., who use for this work isochromatic preparations and colored screens, in order to obtain the relative values of the different tones of the original. From this negative, skillful workmen print four positive prints, which are transferred to wood; the work then passes into the hands of the art engraver, Mr. Meaule, who engraves on each of the blocks the cuts necessary to obtain in the printing all the lines which will deposit on the paper the same color. The blocks are then confided to a worker in galvanoplasty, who moulds and deposits the copper in sufficient quantity to take the place of the wood, and form the metallic block to be used in the printing. The metallic block is strengthened by running lead on the back, then bent according to the diameter of the cylinder of the machine upon which it is fixed.

By the aid of an ingenious contrivance of M. Marinoni's invention the sheet of paper is printed in one color by passing under a first block; immediately it presents itself under a second block, which prints the second color, in the same manner under the third, and finally under the fourth block, which limits and forms the connection by printing the text. With these superposed colors, and by the intervals showing the white of the paper, it is possible to obtain the delicate tones of the aquarelle. This rotary machine, by using colored printing inks, has overcome a difficulty existing when chromo prints are made requiring four impressions. M. Marinoni is now preparing a machine for printing in six colors.—*Progres Photographique.*

Correspondence.

Agriculture in California, 1850 and 1890.

To the Editor of the Scientific American:

Probably no part of the world contains such vast agricultural resources as our Pacific Coast, and none has ever displayed greater genius than her people. Necessity during her earlier periods gave birth to her great work. In 1853, when I first visited her golden hills, agriculture was but in swaddling clothes. All of us sought her mountains of gold, and not her vast and rich agricultural valleys, then rich with guano where sea fowl had swarmed for ages, and wild cattle and other wild animals had roamed over them. The men who went there then, and only remained a short time till they "got their pile," as they called it, never stopped to investigate her agricultural possibilities. A few, however, engaged in agriculture in a quite small way, and soon discovered that to supply the growing cities, villages, and mining camps was very profitable, and safer really than prospecting for yellow metal. Potatoes soon became so abundant that hundreds of tons rotted in sacks or were emptied to save them for another year's sacking. It only cost the plowing and sowing to get a good crop of wheat, but the straw was so enormous, and grew so even in height, that in place of the old reaper the heading machine was substituted. Then came the attachment of the thrasher and winnower, and before I left in 1859, I saw sixteen horses to one machine going through these vast fields, clipping off the heads, which fell into a hopper and were thrashed, winnowed and bagged and dropped along the field, a team following to pick them up. During the summer droughts, as the ground shrank in drying it became full of cracks. Into these would falls ufficient of the grain in harvesting, so that when the rainy weather came, and the cracks partially closed up, a "volunteer" crop followed, which often was quite productive for the third year before a second cultivation was necessary. But the wheat fields then contained considerable oats, scattered by cattle fed on wild oats, that was a spontaneous and natural product of the foot hills.

About two years ago I visited the Pacific coast again, and spent several weeks at Paraiso Springs. In Spanish Paraiso is Paradise, and in these hot springs the old Spanish monks bathed for their health. One day while there a gentleman invited three of us to take a ride with him. The day was beautiful, and behind two flying horses we soon rode about fifteen miles, and came to the edge of a wheat field. "This is my place," said our friend. As we rode on a mile or two I could see no end, and I asked: "How long is this wheat field, sir?" He replied, "About nine miles, and a mile wide." "How much will it average to the acre?" "Oh, about sixty bushels," said he. I saw nothing but clear wheat, without a spear of oats, although I had seen oats in other fields which we passed on the road. "How do you keep out the oats?" I asked. "Well," said he, "I work about four hundred horses and mules to get in my crops, and I am very careful never to allow them to eat whole oats, for if I do, then they drop them along as I cultivate the fields." "Where do you sell all this wheat?" said I. "Oh, I ship it all to Europe, as I can do better with it there than here."

After changing our team and taking another fast pair, we rode over the remainder of his vast estate, which actually contained thirty square miles. In one section was his forest for wild deer, and in another an extensive field for grazing cattle and horses, where I was shown one fat cow that he told me weighed 1,890 pounds. We were soon on the way back to our "Paradise," which we reached about sundown, after one of the most interesting rides that I ever had the pleasure of enjoying. I afterward learned that this gentleman's property was valued at over $5,000,000.

J. E. EMERSON.

The Great Dam of the Periyar, India.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN for February 7, 1891, I saw an account of this great engineering work, now being carried on in Southern India. Permit me to add a few more particulars. Before entering into the details of the work, a few remarks regarding its object are necessary.

The Madura district of the Madras Presidency is separated from the native state of Travancore by the chain of mountains known as the Western Ghats. The average rainfall of this district is about 40 inches a year. It is watered by the river Vegay, which runs dry for the greater part of the year, thus causing almost all the wet cultivation of the district to be dependent on rain-fed tanks, so that on occasions of drought famine is almost imminent, while on the other side of the watershed ridge of the Western Ghats, separating Madura from the Travancore territory, is a vast tract of uninhabited jungle, having an average rainfall of 100 inches a year and watered by a perennial river, the Periyar. This river rises in the Western Ghats, near the boundary between the Tinnevelly district, the most southerly one of the Madras Presidency, and the Travancore State; and its course is generally northeast in the mountains, until, some sixty or seventy miles below, it emerges from the Ghats, and takes almost a direct course to the Indian Ocean, into which it finds its way some miles above Cochin, on the west coast.

Ever since the year 1801 schemes have been drawn up to utilize the superabundant rainfall on the western slope of the Ghats for irrigation in the Madura district; but practical difficulties and want of experience in the methods proposed prevented them being carried out. The present one is a considerable modification of the others, and may be described as follows:

The object of this work is to divert the waters of the Periyar into the Vegay, and this is effected by building a dam 155 feet high across the valley of the Periyar, the site of the dam being seven miles due south of the head of the Gudulur Ghat, on the main road from Madras to Travancore. The effect of this dam would be to back up the river to an extent of eight miles of its length and up its various tributaries, thus forming an immense reservoir, about 8,000 acres in area, meandering through the hills in which the river is embosomed.

The capacity of the reservoir, when full, will be about 13,800 millions of cubic feet of water, of which 16,815 millions will be available for irrigation. For disposing of the flood water the lake will have two waste weirs or escapes, which will be formed on the saddles of the hills on the right and left flanks of the dam. That on the right bank has solid rock at a level of about 150 feet above river bed, and will be cut down for a length of 420 feet to a level of 144 feet, or 11 feet below the crest of the dam. On the left bank, solid rock is at a level of about 100 feet above river bed, and the saddle will be built across with a masonry wall to a level of 144. The length of the wall will be 403 feet, and a further length of 97 feet will be obtained by cutting away the rock at both ends, giving a total length of 500 feet. The two escapes will have an aggregate length of 920 feet. This is considered sufficient to discharge the greatest flood ever known, with a depth of 10 feet on the crests of the escapes.

Up the Muliaparyaim, one of its tributaries, which enters the Periyar at about a mile above the site of the dam, and which also has its source in the watershed ridge separating the valley of the Periyar from that of the Vegay, at a level of 113 feet above river bed at site of dam, a cutting through the watershed ridge, termed the "watershed cutting," is in process of construction, running northward and having a fall of 1 in 440. When the depth of cutting in rock reaches 30 feet, it will be replaced by a tunnel 80 square feet in area, with a fall of 1 in 75. At its lower end the tunnel communicates with the bed of the stream Varia Vennar by a cutting 160 feet long, similar to that at its south end. The total length of the tunnel, when completed, will be 6,650 feet.

The Varia Vennar empties itself into the Toorooliar, which after a length of 46 miles from the mouth of the tunnel joins the Vegay. The waters of the Periyar will be then carried some 40 miles down the Vegay to a place called Perranny, situated about 20 miles west of Madura, where an ancient or low dam is built across the river. Above the ancient an irrigation canal takes off, and is carried as close as possible along the foot of the Allighery and Sirumally range of hills, which form the northern boundary of the Madura district; this canal will be about 36 miles long. The distribution of the water will be effected by twelve branch channels, which are being carried along the ridges of the slopes of these hills, so that they may be in a commanding position to irrigate both sides of the slope, and be as little exposed to injury from cross drainage as possible. The total area irrigated by these channels will be about 80,000 acres. Already 20 miles of the main canal have been opened, and five branch channels completed.

From a professional point of view the work is interesting, as the dam is to be built entirely of concrete, except a casing of rubble masonry in front and rear. Its height, as stated above, is to be 155 feet above mean river bed, the river bed at site of dam being 2,837·36 feet above mean sea level. The bottom width of the dam is 136 feet, top width 12 feet. It will be surmounted by a parapet 5 feet high and 4 feet thick, thus making the total height 160 feet.

The foundation of the dam is rock (syenite), which forms the bed of the river, and which is found at a depth of from 20 to 30 feet below the natural surface of the hills forming the banks of the river.

The limestone for the concrete is obtained at the foot of the hills, at a distance of some 12 miles from the site of the dam. An analysis of four specimens shows it to be an eminently hydraulic lime and well suited for the work.

It will be conveyed up the ghat to the head of the "watershed cutting" by a wire tramway about 12,000 feet long, having a general rise of about 1 in 10, the power for driving the tramway being a Girard turbine of 30 horse power, with a fall of 160 feet. From the head of the "watershed cutting" the limestone will be carried down the Muliaparyaim in barges, the tributary being rendered navigable by means of a lock and four dams, the limestone, at the dams, being transported from the barges in the upper reach to those in the lower reach. The stone is at present obtained from the cutting made through the hill to form the right bank escape, and when this is exhausted it is proposed to convey the stone from the "watershed cutting," down the Muliaparyaim in the same manner as the limestone.

Excellent sand for mortar is obtained from various parts of the bed of the river. It is at present raised by means of hand dredgers, but will in future be raised by means of a sand pump, which is an ordinary 6 in. centrifugal, having a set of cutters working at the end of its suction pipe. The concrete is manufactured entirely by machinery, the power for driving the same being an inward-flow Waverley turbine, developing 150 horse power with a fall of 20 feet, and is worked by the river itself. The plant consists of six Baulus portable stone crushers, four disintegrators for pulverizing the lime and burnt clay, the latter being added if the lime is found not sufficiently hydraulic; two mortar mixers, and two concrete mixers. The materials are measured automatically by means of drums, which are all placed on the same shaft and worked by gearing from the countershaft driving the mortar mixers. The porportion in which the ingredients are mixed is: 25 parts of lime, ground but not slaked, 30 parts of sand, and 100 of broken stone. If burnt clay, or "sueki," as it is termed, is added, the proportion of sueki will be the same as that of the lime. From the measuring drums the lime and sand pass into the mortar mixer and from thence into the concrete mixer, where the mortar meets the stone, which is measured directly into the latter. A pump supplies the necessary amount of water and also feeds a small service reservoir, from which water is distributed to the various houses of the engineering staff. From the concrete mixers the stuff is discharged into trucks, which carry it to a wire tramway, driven by a belt from the main shaft of the workshop. This tramway first carries it across the river, and then along the front of the dam, the empty buckets bringing back the raw materials, which are brought by the barges to the front of the dam.

The great difficulty that presents itself at present is the disposal of the water during the construction of the dam. The method now adopted is raising the water as the dam is being built up and diverting it round the right flank of the dam, and from thence allowing it to flow down to the workshop, which is situated on the right bank of the river and in rear of the dam.

The operation of boring the tunnel is carried on, at its lower or north end, by means of machine drills, worked by compressed air, the power being a Girard turbine of 50 horse power, with a fall of 150 feet. The whole of the tunnel is through hard syenite, which forms these hills. At the upper or south end a shaft is sunk and the tunnel is carried downward by hand drilling. Two semicircular tunnels taking off from the east and west face of the shaft connect it with the watershed cutting. Somewhere about the center of its length another shaft is being sunk, and the tunnel will be worked from both faces, by means of machine drills driven by compressed air, the power being steam.

Some idea of the difficulties of the work may be gathered from the fact that a river, flowing through banks formed by hills and subject to heavy floods, causing it to rise sometimes ten feet in a few hours, has to be gradually raised and diverted during the construction of the dam; and also the work has to be of such a character as to be able to stand any scouring action from the river, which, during flood time, frequently rises to the extent of completely overtopping and submerging the works; often causing considerable annoyance and delay. To this may be added, that for three months in the year the place has to be left, owing to the malarious fever which spreads over these places during the hot, dry months of April, May, and June, rendering it unhabitable except to a few hardy ones.

B. C. E.

Periyar, Madura District, South India.

Lead-Coated Zinc.

A process of coating iron with lead on zinc has been exhibited in operation at the works of Messrs. Joseph Westwood & Co., Napier Yard, Millwall. It consists in first pickling the iron articles to be coated with lead in a weak acid bath, through which a mild current of electricity is passed. This loosens the magnetic oxide or scale and cleans the iron, which is next placed in a lime water bath, by which the acid is neutralized. The iron is then washed in a bath of clear water, all three baths having a temperature of 120° Fah. The next step is that of immersing the iron goods in a liquid metallic bath, composed of zinc and tin in equal parts, in a solution of hydrochloric acid, at a temperature of 110° Fah. The iron is subsequently passed through a bath of molten lead in the same way as in the ordinary galvanizing process, and this gives it the desired lead coating. The coating is said to be very strongly adherent, and to withstand very severe treatment.

A. C. HOBBS, THE LOCK EXPERT.

The death, on October 6 last, at Bridgeport, Conn., of this most noted of American lock experts, recalls many striking incidents of his remarkable professional career, for in the study of locks and the mechanism of opening them he made a unique profession and a world-wide reputation. He was born in Boston, October 7, 1812, his father being a carpenter and joiner, from England, and his mother coming from Wales. At ten years of age he commenced his work as a boy on a farm, which was followed by a place in a dry goods store, and that by commencing to learn wood carving. Carriage body making came next, and then a short trip as a sailor, after which tin plate work and coach and harness trimming were tried, to be followed by an apprenticeship at glass cutting, an occupation he followed for about eight years. In connection with cutting glass door knobs he invented and patented a new method of fastening the knobs in the socket by which they were attached to the lock, by which he was first brought in contact with lock makers. He afterward opened a store in New York to sell locks and fireproof safes, and made a specialty of bank locks. He got up for himself a very fine set of tools for opening vaults and safes, and made his first call with them and one of his own locks on a bank at Stamford, Conn.

They had on their doors a Jones padlock, which held an iron strap over the keyhole of an Andrews bank lock which had cost the bank $150. In addition they had a warded lock, making three locks, any one of which was considered quite secure against being opened without the proper key. Also a supposed secure lock was placed on the outside door of the bank. The bank directors decided that if the lock on the outside of the door and those on the vault could be opened in two hours without injuring the locks, they would purchase a new lock. Mr. Hobbs then, after examining the keyholes, selected a few instruments from his assortment, opened the outside door and the three locks on the vault in twenty-three minutes. No further argument was needed, the new lock was purchased, and their vault made secure. This occurred in January, 1847. From that time until 1851 his whole attention and time were occupied in visiting banks, including nearly all in the United States.

A. C. HOBBS.

In 1848 Mr. Hobbs was at the bank of Lancaster, Pa., putting on a lock that he had sold them. As the cashier came in the bank with his morning paper, he said, "Mr. Hobbs, there is something for you," throwing down his New York paper, in which was an advertisement from a Mr. Woodbridge, of Perth Amboy, offering $500 to any one who would open his lock then on one of Herring's safes in the Merchants' Exchange reading room in New York. Mr. Hobbs said to the cashier, "That is my money." "What," said he, "do you think you can open it?" "Yes," said Mr. Hobbs, "and I leave for New York as soon as I have finished putting on this lock."

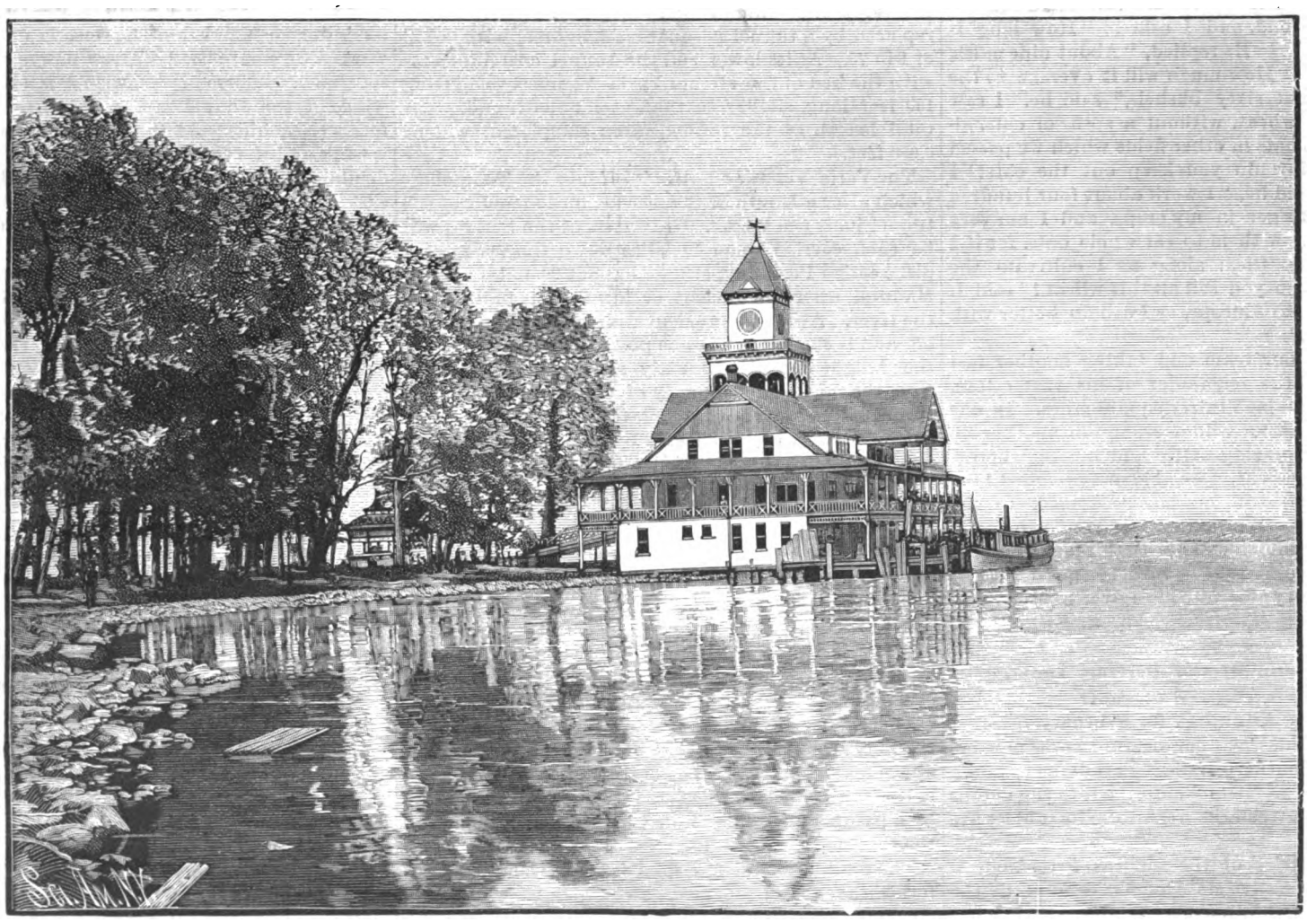
Mr. Hobbs went to New York and had thirty days in which to open the safe, within which had been placed a check for $500. The room was cleared at 9 o'clock in the evening, and at 11½ Mr. Hobbs had the position of all the tumblers marked out and a wire inserted by which the bolt could be withdrawn. Early in the morning he sent word to Woodbridge that something was the matter with the lock, and requested him to come in at 10 o'clock. Woodbridge was delighted, as he had arranged that if any instrument should be inserted in the lock and the tumblers were not in proper position, such tool would be locked in and could not be withdrawn. At 10 o'clock Woodbridge, the directors, and the arbitrators were on hand, and Mr. Hobbs carefully moved the wire which he had watched for three hours and then pulled open the door of the safe and secured the $500. In April, 1851, Mr. Hobbs went to London to examine a wonderful lock made by Brahma. There was a standing offer of 200 guineas to any one who should be able to open it without the key. A committee was appointed, long articles were published in the newspapers, and the trial began. It took Mr. Hobbs fifty-one hours to pick the lock, and there was a complete overthrow of the locks in general use in England. William Brown of Liverpool was the inventor of a later lock which was used on the safe of Brown, Shipley & Co., bankers, and in order to open it the letters of a word were selected from a dial on the door. Mr. Hobbs called at the bank and had an interview with Mr. Brown, who locked the safe and then said that it was utterly impossible to open it without knowing the combination. While conversing with Mr. Brown, Mr. Hobbs stood with his back to the dial, and with one hand behind him unlocked the safe and pronounced the lock worthless.

Mr. Hobbs began lock making for himself in Cheapside, London, and in time the business grew enormously. In 1860 he came to New York, but retained his interest in the firm of Hobbs, Hart & Co. Then he took charge of the Howe Sewing Machine Works in Bridgeport, and in 1866 was placed in charge of the Union Metallic Cartridge Works of Bridgeport, of Schuyler, Hartley & Graham of New York. A few buildings were erected. The works have grown to be the largest in the world of the kind, from 1,500 to 2,000 hands being constantly employed in filling orders from all parts of the world.

Mr. Hobbs continued to superintend the works until three years ago, when he was succeeded by his son, Alfred J. Hobbs, the present superintendent. Mr. Hobbs had been called Commodore for many years because of his active interest in yachting sports. He was owner of the yacht Quinnipiac, on which he spent a good portion of his leisure. He leaves one son, two daughters, and a widow.

CHAUTAUQUA.

Who has not heard of Chautauqua? That great literary center whose influence, perhaps, permeates the entire globe. Certain it is that among all degrees of literary culture, from that of the university man down to the graduate of the simplest village school, the Chautauqua "circles" claim their devotees. They have found entrance even through the dense walls of our prisons and penitentiaries, and many darkened hearts whose weary existence hitherto knew no hope, no interest, now bless the name of the inaugurator of the movement, good Bishop Vincent, as, in the pages of their histories, they study the progress of the world, and thus lose sight of their own darkened past and despairing present.



THE DOCK AT CHAUTAUQUA.

Yet this great literary center, this beehive of intellectual activity, is comprised in some fifty acres of New York soil, situated on a ten mile strip between Lakes Erie and Chautauqua, the latter being 700 feet above the level of Lake Erie. The Assembly Grounds are three-quarters of a mile long by one-quarter broad, and inclosed by a high fence, beyond which, for ingress or egress, one may not pass without permission, procurable only by presentation of a Chautauqua ticket.

Taking the steamer at Mayville, on the shore of Lake Chautauqua, we cross to the summer city, landing at "The Dock," a tasteful wooden structure gleaming white across the waters; and having purchased our tickets, in delighted wonderment we pick our way over the miniature Palestine, said to be a perfect representation of the Holy Land. It is laid out on a scale of two feet to a mile for horizontal distances, and 380 for vertical measure, with the various towns and villages represented in plans on plaster mounds.

Leaving the main road at "Beersheba" we follow the valley of the Jordan to the city of "Dan," threading our way among the Bible students, who with open maps in hand attentively study the plan beneath their feet. Taking a seat for a moment, perchance in the grateful shade of Mount Hermon, we plan a future examination of the ingenious model which, in all probability, we never get a chance to execute, owing to the continuous succession of prayer meetings, club meetings, "round table" discussions, concerts and lectures, each, in its way, a literary treat, from the moment of opening our eyes in the tiny, sweet-smelling bedrooms of the cottages, roused by the cry of the newsboys—"Chautauqua Assembly Daily Herald!"—to the close of the busy day, when, with lights out and windows open to the quiet sky, we woo the fresh straw ticks and smile ourselves to sleep, soothed by the lullaby of the good old curfew.

But besides the literary and musical entertainments which are open to every visitor, the various summer schools of music, elocution, physical culture, dress reform, photography, cooking, and Christian sciences prove very fascinating to young and old alike. The superficial observer can form no conception of the value and thoroughness of the work done in these brief summer schools. Take, for instance, that department of the School of Physical Education under the charge of Mrs. Coleman E. Bishop, whose lithe, light form and easy grace give ample testimonial to the efficacy of the Delsarte system, of which she is a leading exponent.

In the daily exercises of this class the nervous system is so trained and developed that an amount of lightness and grace never before dreamed of is acquired by the delighted student, and it is claimed that the dignity of the body gives dignity to the mental and moral nature, just as true as the lofty mind and pure heart, when not counteracted by self-consciousness, find a natural expression in dignified carriage. The system is a revelation to those nerve-bound persons who, with well developed muscles, keep such tension upon them when not in use that their vital force is uselessly squandered. It teaches how to conserve vital energy; how to avoid wasteful nerve tension; so that the student works better, rests better, and also, by the physical exercise of certain nerves, gains more brilliancy and activity of mind.

Nor are the other schools less profitable, less interesting. The voice of the declaimer, the notes of the singer, the tones of the organ, are heard on all hands; and Professor Charles Ehrmann and his troop of amateur photographers, armed with cameras, excite the envy of those who have not been fortunate enough to secure his instructions.—*Annie Crawford in Dominion Illustrated.*

Improved Alloys.

These are alloys for the manufacture of boring and cutting tools having a hardness equal to that of tempered steel, with the further advantage of not losing their hardness when heated by friction. The following alloy is suitable for the manufacture of boring tools such as drills, milling cutters, reamers, and the like:

Pig iron	17·25
Ferro-manganese	3·00
Chromium	1·50
Tungsten	5·25
Aluminum	1·25
Nickel	0·50
Copper	0·75
Bar iron	70·50
	100·00

The following alloy is suitable for the manufacture of nail-cutting blades, cutting blades for machines, cutting-out tools, and the like:

Pig iron	17·25
Ferro-manganese	4·50
Chromium	2·00
Tungsten	7·50
Aluminum	2·00
Nickel	0·75
Copper	1·00
Bar iron (Swedish)	65·00
	100·00

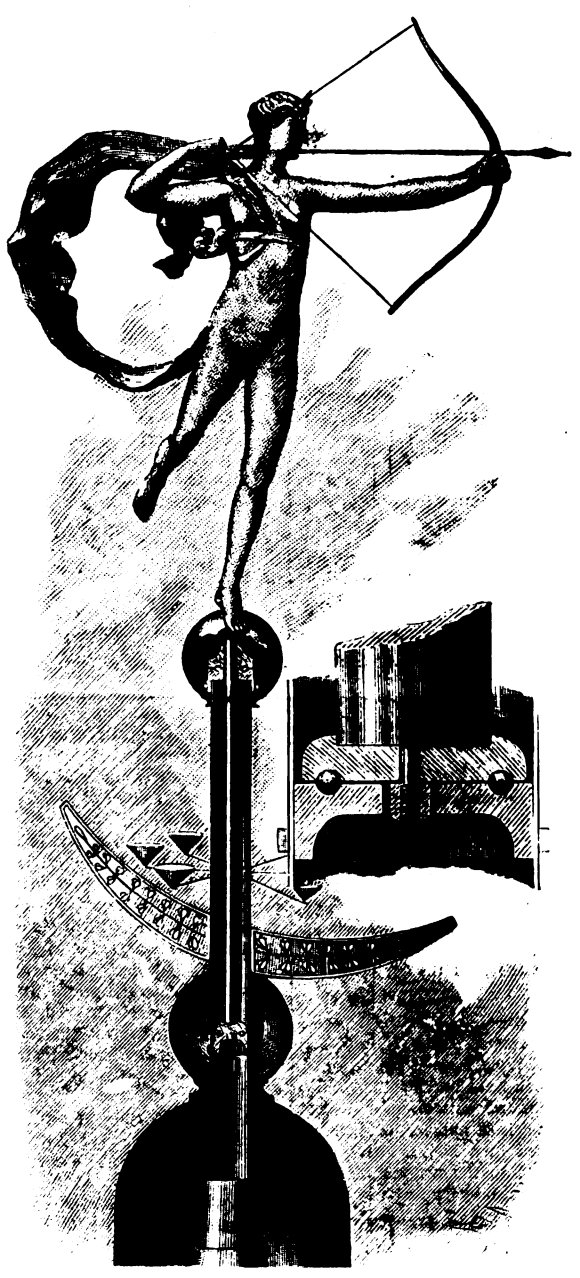
In making these alloys the pig iron, ferro-manganese, chromium, and tungsten are melted together in graphite crucibles under stick charcoal and calcined borax, the tungsten and pig iron being preferably melted first. The alloy so produced is then remelted in clay crucibles together with the bar iron; and the nickel, copper, and aluminum are then added. The metal is this time covered with stick charcoal only. The above alloys are cast in sand moulds.—*F. W. Martino, Sheffield, and F. R. Martino, Birmingham.*

THE MADISON SQUARE GARDEN WEATHER VANE, THE HUNTRESS DIANA.

The tower of the new Madison Square Garden, of this city, has recently been completed, and has been surmounted by the great weather vane representing the huntress Diana discharging an arrow in the direction whence the wind is coming. On account of its elevated position and high artistic character the colossal statue, for such the weather vane really is, has attracted much attention. The general design is due to Mr. Stanford White, of this city, who was the architect of the building and the tower, and who is the architect of the Washington arch in this city, now approaching completion. The statue proper is the production of the celebrated sculptor, Augustus St. Gaudens. The full sized model was supplied from the artist's studio, and the statue was reproduced in metal by W. H. Mullins, of Salem, Ohio.

The statue, whose general appearance is given very accurately in the cut, is 18 feet in height, and, with its iron frame, armatures, and counterpoising, weighs 1,800 pounds. It is made of 22 ounce copper, struck up in drop presses. The process of manufacture was as follows:

Using the statue as a model, a number of plaster of Paris moulds were made to cover, section by section,



THE MADISON SQUARE GARDEN WEATHER VANE, THE HUNTRESS DIANA.

the entire figure. From each of these moulds a casting was taken, the cavity being filled with melted zinc, thus giving an accurate male die, reproducing every detail and roughness of the original statue. Female dies were made, also of zinc, using the male dies as a base. The statue was struck up from these dies. A corresponding pair were placed in a drop press and accurately adjusted. Sheet copper, cut to proper size and placed between the dies, was gradually struck up by a succession of blows, with constant annealing between the impacts. In general the female dies were continually replaced by others of increased depth, a single male die in general answering for each part. A shallow rebate was worked upon some of the edges of the pieces, so as to enable a comparatively flush joint to be made by lapping an unrebated edge thereon. The whole was then riveted together and finally brazed so as to produce a water-tight structure.

The frame consists principally of wrought iron pipe. A 7 inch pipe runs up through the central axis of the figure to the head, and to it other pipes, bars and stays of iron are secured, running to and attached to different parts of the figure as required.

The foot of the figure rests upon a hollow ball, 22 inches in diameter; an extension of the central 7 inch pipe runs down a further distance of 9 feet; and this is surrounded by a 10 inch pipe, which extends up a short distance through the bottom of the upper ball. The lower ball is 3 feet 4 inches in diameter.

It is obvious that as the statue turns, the 9 foot section of pipe must also turn, and that the upper ball attached to the figure turns with it. The construction, it will be seen, absolutely excludes all rain from the interior of the 10 inch pipe. The weight of the figure is sustained by two horizontal ball bearings, about 9 feet apart and within the 10 inch pipe and lower ball. Each bearing consists of two annularly grooved flanges, between which a number of 1½ inch steel balls work within the grooves. By adjustment of the relative parts, principally as regards the location of the frame, the center of gravity is brought as nearly as possible to fall upon the axis of the 7 inch pipe. A bolt and nut at the bottom of the rotating pipe holds the figure down to its position, so that it cannot leave the ball bearings. It is found that a wind pressure of one-fourth of a pound to the square foot is sufficient to move the statue.

Below the figure is the great crescent, measuring about 12 feet from tip to tip and 22 inches in horizontal depth. This is built upon an angle iron frame. The sides and bottom are closed with plate glass in small panes, and a series of lids close the top. Within the crescent are 66 incandescent lamps, ten of 50 candle power and the rest of 16 candle power each. Immediately above the crescent, ten reflecting lamps are arranged to cast their rays upward upon the figure. These are carried by ten arms of gas pipe.

The apex of the figure is 347 feet from the ground. The highest point accessible by fixed ladders is the crescent, 323 feet from the ground.

A lightning rod connection with the rotating figure is thus arranged: The upper part of the 10 inch stationary tube is surrounded with a copper ring immediately under the upper ball. From this ring six arms of copper rod extend upward, terminating in points almost in contact with the ball, which latter, it will be remembered, turns with the figure. From the ring the main lightning conductor is carried down to the ground.

Ice Cream Diet.

Dr. Herstey reports, in the *American Medical News*, three cases of gastric ulcer in which recovery had followed the use of a diet of ice cream. This novel method of treatment was suggested to him by the experience of a patient, a woman of thirty-five, who had for three months suffered from symptoms of gastric ulcer. She had hæmatemesis and severe pain, and could retain nothing until by chance she one day took a small quantity of ice cream. She had lost 25 lb. in weight. As all ordinary methods of dieting had failed, and digested food administered by the rectum was rejected, the patient at her own desire was allowed ice cream, and told to take as much of it as she could. Her severe symptoms at once began to subside, and at the end of two months, during which from one to three quarts of ice cream were taken daily, she had gained 24 lb. in weight. Solid nourishment was gradually added to her diet, and she made a complete recovery. Dr. Herstey had a similar experience with two other patients, in one of whom there were symptoms of perforation and local peritonitis, and he is naturally inclined to think highly of the mode of treatment and to recommend its use in similar cases. He believes that the ice cream in those cases is beneficial because of the local anæsthetic action of the cold permitting digestion to go on without pain, while at the same time sufficient material for digestion and nourishment is supplied in the cream. But he insists that every care must be taken to insure the absolute purity and freshness of the ice cream, and for this purpose he recommends that only that which is made at home should be used in such cases.

Grand Marais Harbor, Michigan.

At Grand Marais, Mich., nine miles east of Big Sable light, thirty-five miles east of Grand Island, and forty-nine miles west of Whitefish Point, the government has made a deep water harbor, now in readiness to afford shelter to vessels in the Lake Superior trade. The width between the piers is 500 feet, and there is at this time a channel into the harbor midway between the piers having a width of 175 feet with not less than 17 feet of water in it. The full width of 500 feet between the piers will in time be dredged to a sufficient depth for Lake Superior vessels. The harbor is about a mile and a quarter long and 1,000 feet wide in its narrowest part.

THE Densmore Typewriter Company have lately added some novel features to their machine, one of which is a diagonal ribbon movement which greatly increases the printing life of the ribbon and continually brings fresh ink to the letters, prevents central wear, etc. These improvements will be greatly appreciated by all users of the machine.

RECENTLY PATENTED INVENTIONS.

Engineering.

AUTOMATIC SHUT-OFF FOR ENGINES.—Peter Davidson, St. Mary's, Ohio. This invention relates to stationary engines which have no governors for regulating the throttle valves, and provides for rigidly connecting the valve with a rod sustained by a trip support, and arranged to be tripped or dislodged by the jar of the engine in speeding. The device is designed to automatically shut off steam and stop the engine when an accident occurs, like the breaking of belts, etc., while it may also be arranged to afford facility for the proper regulation of the flow of steam, and is applicable to either the throttle or butterfly valve.

HYDROCARBON BURNER. — Joseph Burns, Fort Plain, N. Y. This invention is designed to afford a simple and durable burner which will permit the operator to change the intensity of the flame whenever required, and direct the flame to any desired place in the furnace. The main air pipe is provided with a smaller concentric air pipe open at both ends, into which extends a sliding and burning oil tube, having on its front end a burner proper and a faucet. According as the operator turns the oil supply pipe he changes the position of the burner, so that the flame varies correspondingly, the sheet of flame extending horizontally, at an inclination, or vertically, while the intensity is varied as the pipe is moved inward or outward.

Railway Appliances.

CAR COUPLING. — James H. Sweeney, Franklin, Tenn. In this device the link lifter has a shaft provided with a toothed segment or plate engaged by a pawl, a rod connected at one end with the pawl being projected at its other end through a slot in the drawhead, where it is connected with a pin support. The arrangement is such that cars of different heights or with straight or bent links can be conveniently coupled thereby, the pawl being released and the link lifter operated from the top of the car or by crank handles from either side.

CAR BRAKE.—Henry F. Braun, Denison, Texas. The ordinary brake beams are dispensed with by the use of the car brake mechanism provided by this invention, the several brake shoes carrying self-adjusting levers. Combined with the operating brake rods and independent shoes are fixed lever arms having a fixed pivotal bearing in the car frame, and independent lever arms connected with the brake shoes, the fixed arms, and the operating rods, the independent levers transmitting the brake power to the shoes. The operating lever rod can be arranged to be operated by air pressure if desired, and the mechanism can be readily adapted to car bodies now in general use without changing their construction.

Mechanical Appliances.

BRICK AND TILE CUTTER. — Davis Brown, Decatur, Ill. This is an automatic cutting attachment designed especially for machines delivering long bars or a continuous bar of clay, to cut them into suitable lengths, the construction being such that the cutting surfaces are readily changed when damaged. The table and the measuring roller belt of the attachment are so arranged that should the column of clay cease moving, the operative parts of the attachment will be simultaneously stopped, while the driving speed is regulated according to the delivery of the bars of clay.

CARPENTER'S GAUGE.—Christopher C. Harris, Missoula, Montana. This invention consists of a bar having a fixed head and a movable head, an L-shaped guide rod sliding with one end on the fixed head while a connecting arm sliding on the guide rod is connected with the movable head. The implement is of simple design, and convenient to mark for hinges on doors and jambs, to facilitate the hanging of doors and for use by other mechanics.

Miscellaneous.

AERIAL MACHINE. — Stewart Cairncross, Grafton, North Dakota. This air ship has a skeleton frame with a smooth closed bottom, a short distance over which are held gas bags designed to assist in lifting the machine and supply gas to engines to work propellers for directing and steering the machine in the air, as well as for lighting and heating cars to be carried by the machine. The invention is an improvement on a former patented invention of the same inventor, providing a construction designed to be light in weight but of great strength, and under the ready control of the operator in ascending or descending or traveling in any direction.

TYPEWRITING MACHINE. — Michael Hearn and Morgan Donne, London, England. The patent of this machine presents an elaborate exposition, in eight pages of drawings and six pages of specifications, of its various parts and their combination and arrangement. It has independent type levers, normally held vertical by gravity, and at their ends furnished with long type pieces having several characters upon the face, while a cylindrical platen mounted in a frame is connected by arms and a rocking shaft with a lever adapted to receive a differential depression by pistons to bring the platen into position to receive the impression of the capitals or the numerals of the type pieces. The ribbon may be moved out of the way if desired and the machine be employed to produce a stencil in waxed paper.

TYPEWRITING MACHINE.—Jefferson M. Prentice, San Francisco, Cal. This improvement consists in arranging a shift bar at the front of the machine parallel with the ordinary space bar, and in the means for connecting it with the platen or roller, and makes a Remington No. 2 available for persons having the use of but one hand. The keyboard is simplified by the removal of two keys, and the substitute for them is not a cumbersome addition to or enlargement of the machine, extending but one-fourth of an inch from the front and having a top flange that fits snugly up to the space bar.

TELEGRAPH KEY.—Louis F. Robare, Au Sable Forks, N. Y. This is a simple legless key from which the regular binding posts are omitted, the key being formed of a base plate, while pillars form the bearings of the key trunnions and serve as binding posts. The construction obviates the necessity of driving staples into the table on which the key is mounted.

JEWELER'S TOOL.—Frank Heller, Brazil, Ind. This is a watchmaker's ruby pin setter, and consists of a handle having a chuck to hold the balance staff and a head with a series of grooves to receive the roller pin, with a clamping device to hold the roller pin in position in the roller table while the cement is applied. With this tool a roller jewel of any watch may be quickly and accurately secured in place.

CLOTH MEASURING MACHINE.—Hubert Hebert, Lake Linden, Mich. The main frame of this machine contains a winding mechanism, and a spring-pressed strip mounted on a cross piece of the frame is provided with adjustable guide pins, a register being supported on horizontal slides so that it may be rotated by the traveling cloth. The construction is simple, and by means of the machine loose cloth may be rapidly and nicely rolled into a web, or cloth may be rolled from one board upon another, and in either case may be accurately measured.

SHOW CASE.—Charles A. Bacon, St. John's, Mich. This case is more especially designed for the display of plug tobacco put up in caddies, and has a door and one or more glazed sides and inwardly projecting adjustable arms to support the caddies. Arranged to project down within the top of the case is a dampening box having perforated sides, within which is held a wet sponge, the tobacco being thus kept moist and free from dust and dirt.

SHUTTER FASTENER. — William B. Liming, Philadelphia, Pa. This is a simple securing device for the detachable connection of one folding section of an inside shutter or blind to another section of the same window blind. It consists essentially of a cylindrical spring box, to be embedded near the center of length of a shutter or blind, in one of two adjacent sections, the device facilitating the manipulation of sectional folding blinds by detachably locking two or more sections together.

FIRE ESCAPE.—Henry Schwannecke, New York City. This improvement consists essentially of two chairs or balconies so connected that when one descends the other will ascend, the balconies being provided with suitable tracks, and cushions being so arranged that the occupants of the balconies or chairs will sustain no shock when the balconies reach the ground. This fire escape is designed to be placed at the side of a building without detracting from its appearance, and the construction is simple, durable, and inexpensive.

HOSE COUPLING —Ransom Reid and James P. Browne, Santa Ana, Cal. An exterior annular bevel is, according to this invention, formed on the male member of the coupling and adapted to engage a correspondingly shaped opening in the female member, hooks being mounted to slide in the female member and engage the back of the bevel to draw the male member to its seat. The device facilitates a ready and convenient coupling and uncoupling.

WHEEL. — Evert Takken, Douglas, Mich. A vehicle wheel constructed in the manner provided by this invention is designed to be readily adjusted to take up all wear, and to be easily repaired in case of being injured. The hub has at its inner end an offset and supports dished rings, one of the rings abutting against the offset and both having parallel flanges with recesses through which the spokes extend, while a nut screws on the outer threaded end of the hub against the outermost ring, and bolts fasten the flanges of the rings together.

FOOD MILL. — James D. Smith and Thomas H. Duhart, Worcester, Mass. Bread and similar articles may be rapidly and conveniently crumbed by this mill, which has a horizontally revoluble cylinder with a perforated bottom, near which, within the cylinder, are held a number of inclined knives, saws being mounted in a hopper above from which material is delivered to the cylinder, and the saws and cylinder being turned by a gear mechanism.

SEWING MACHINE SPOOL RACK. — Luise Lewy, New York City. Combined with a post having a fixed and a hinged arm is a disk turning between the arms from which extend spool-carrying spindles, a locking plate on the hinged arm engaging the outer ends of the spindles, with means for locking the disk to prevent its turning. The device is designed to hold and lock a number of spools in place, and prevent tangling and waste of the thread, while guiding the thread of one of the spools to the head of the sewing machine, the ready unwinding of the threads in work being facilitated.

VEIL HOLDER.—Linnie A. H. Grenelle, Hampton, Iowa. The body portion of the holder, which may be of crescent shape, plain or ornamented, consists of two pieces detachably connected together, to which are hinged pins having knuckle-like projections, there being springs within the body pieces engaging the projections of the pins. The device is designed to make a pretty hat or bonnet ornament and may also be used as a clasp for collars, ribbons, etc.

NECKTIE FASTENER.—James A. Morris, Atlanta Ga. This is a skeleton or open frame, designed to be struck up by dies from a single piece of sheet metal, and having a finger projecting outward from one upper corner and a retaining tang projecting inward to engage a portion of the neckband after it has been passed under the finger. The device is designed to afford means to arrange a scarf in the "four-in-hand" style in a speedy manner without a mirror.

COVER FOR TABLES OR STANDS.—Fred E. Waring, Saratoga Springs, N. Y. This is a simple and convenient cover which may be made to disappear through a slot in the table or stand, and is adapted to cover a phonograph or other article. The cover is of a semi-cylindrical shape and has its ends cut away, while cleats are pivoted at their outer ends to the support and pivotally connected at their inner ends with the ends of the cover.

BURGLAR ALARM. — Carl Guelich, Ottawa, Kansas. In a suitable casing is a bell and a pivoted striker, a shaft in the casing having a crank engaging a slot in the striker, while a drum on the shaft carries a rope or cord whose outer end is connected with a weight resting on the bottom of the casing, a string being also secured to the weight, by which it may be withdrawn from the casing. The device may be conveniently carried about and set up in any place desired, the string being stretched across the anticipated path of the burglar, whose pressure against the string withdraws the weight and sounds the alarm.

DUMB WAITER. — Michael Sullivan, Highwood, Conn. An improved lift for dumb waiters, sashes, and similar articles is provided by this invention. Within the frame is an upper transverse shaft having an operating pulley, a small fast gear, and a loose drum with a large gear, from which extends the cable suspending the waiter, while there is a lower shaft with a large and small fixed gear meshing at all times with the other fixed and loose gears. The improvement is an inexpensive mechanism, designed to be very simple and durable.

GAME BOARD. — Edwin L. McConaughy, Philadelphia, Pa. This board consists of a flat table with a cushion around its edge and an air jet device located near its center and adapted to radially project a light ball on the table toward any one of a series of pockets formed at different points in the top surface of the table, the pockets having different values to be counted in the game when filled by a ball.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention and date of this paper.

Business and Personal.

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

Notes & 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.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(3786) D. W. writes: I have constructed an induction coil and it does not work, so I should like to have you tell me what I have done wrong. The primary coil is 5½ inches long and composed of 2 layers of No. 20 single-covered wire wound on a core of No. 18 annealed wire and is ⅝ inch in diameter. The core I bound tightly together and soldered at one end. Was that wrong? The secondary is 5½ inches long and 1 inch in diameter and is composed of 8 layers of No. 31 single-covered wire wound on a spool of heavy wrapping paper and each layer shellacked. I have tested both coils singly and they work in circuit with a detector galvanometer, showing that there are no breaks or short circuits, but when I connect up as it ought to be it will not work. A. Your primary wire is too fine and your secondary wire is too coarse to secure good results. Two layers of No. 16 would have been better for the primary and twelve or fifteen layers of No. 36 wire for the secondary. It would have been better to have omitted the soldering together of the wires forming the core. For such a coil you should use two or three cells of plunging bichromate battery, or any other battery of equal strength.

(3787) C. W. S. says: I have a nice flat-bottomed row boat, in which I would like to use a sail, but I do not want to put a center board or keel board in it. I have heard of using lee boards, but don't know how to use one; you will oblige me by letting me know if possible how to use a lee board. A. You can make a single or double lee board by making a frame of ⅝ round iron as long as will reach across the boat, with the ends turned at right angles and flattened, with screw holes to attach the lee boards, which should be made of thin oak sharpened on the edges and of sufficient size to sink to the proper depth. The iron frame to be dropped into the row locks, or an eye may be attached to the gunwales to hold the frame.

(3788) R. S. G. asks: 1. Which side of leather belt should be placed next pulley, and reason? A. The flesh side of leather belts is usually put next the pulley, but the hair side has the best pull, and is used in this way by many. It is probably the appearance of the belting when fitting up new mills that keeps the hair side out. 2. Why should a water gauge, glass tube, break afterward, if washed when taken out to be cleaned? I hear it claimed that it will do so, but will not if wiped dry. The breaking to happen soon after it is used, or within a day or so. A. Water gauge

glasses crack by cleaning, from minute scratches made on the inside. It matters not how you clean them, provided you do not scratch the inside. The inside surface is under tension from imperfect annealing and only requires the slightest scratch to start a crack. 3. What color is said to be strongest? Also give relative strength of red, blue, yellow, violet, and purple and white light? A. Of the colors of the spectrum, the yellow is the strongest. Then follow orange, green, blue, red, indigo, and violet. The relative numbers being 100, 64, 48, 17, 9, 3, 3. White light, being the same beam from which the spectrum is separated, represents 244 in the above scale.

(3789) J. H. C. asks: Will you give information how to photograph on china and the method of burning it in, or firing it? A. SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 382 and 429, contains full information.

(3790) W. D. L. asks what to put on a lamp wick to light it with a piece of ice? A. A piece of potassium laid upon the wick can be used for the above purpose. A small piece only should be used, as it is liable to fly about with a sort of explosion.

(3791) M. P. asks how to make the red lead, used in the preparation of storage batteries, adhere to the plate. He has used plates perforated with ⅛ inch holes. The litharge keeps well and hardens quickly, but the minium will fall in powder as soon as it comes in contact with the acidulated water. A. We refer you to a recent article in the SCIENTIFIC AMERICAN, in which the writer recommends wrapping the electrodes to which the red lead is applied with paper, and keeping them so wrapped until after the battery is formed, then removing the paper and replacing the plates in the solution.

(3792) I. G. says: Please decide for us whether the dew rises from the ground or falls to the earth in the form of vapor. A. Dew may be derived from moisture from the ground or from excess of moisture in the air near the earth, coming in contact with vegetable or other substances that have become cold by radiation. Dew falling upon metallic roofs is free from the influence of ground moisture, and is due to saturation of the air by cooling of both air and metal by nocturnal radiation.

(3793) J. H. & S. E. N. ask why the Manhattan Elevated Railroad Company have adopted the new shape smokestack; does it possess any saving qualities? A. The change is supposed to have been made to arrest sparks or cinders, which are more or less a nuisance by falling on the clothing and goods of people on the street.

(3794) O. O. E. asks: 1. Is there anything I can mix with wax so as to make it hard so that it can be worked into models, gear wheels, etc., and yet be melted afterward? Can this be done with tallow? A. Tallow will not harden. Try resin with your wax; 10 to 20 parts will make it much harder and fairly tough.

(3795) H. M. W. asks: 1. Is it possible to burn water? If so, how is it done? A. It cannot be burned. Hydrogen binoxide can be produced by special methods, but they do not involve "burning water." 2. Is a temperature of 3,000° Fah. ever obtained in any blast furnaces? A. A temperature of over 3,000° Fah. is supposed to be produced in the blast furnace. It is impossible to give the exact temperature attainable under given conditions of size, fuel, flux, etc.

(3796) J. H. W. says: Please tell me how to make an inexpensive filter to filter machinery oil, after said oil has passed through Roper's oil extractor. A. Oil from the centrifugal should be allowed to settle in tanks and then drawn off from the top. If filtration is then needed, the oil should be run through woolen cloths or blankets, two or three thicknesses, spread on the bottom of a sieve or attached to a hook like a bag and hung in a barrel or oil can.

(3797) D. J. McI. writes: 1. I want to make my watch dial luminous. In what way should I prepare a solution of phosphorus for application to dial so that there will be no danger of the phosphorus igniting, and when dry it will be luminous? A. The substance to use is not phosphorus, but sulphide of barium or some other earth-metal. The compound is sold in commerce as Balmain's luminous paint. It is described in the "Scientific American Cyclopedia of Receipts." What is celluloid, and how is it made? A. It is a mixture of nitro-cellulose and camphor. The mixture, to some extent a species of solution, may be effected by heat, kneading and rolling, or by the use of other solvents such as alcohol and ether. 3. How are gelatine plates containing potassium bichromate made? How long should one be exposed under a negative to the light, and after being exposed, how treated to leave a raised surface to represent the lights? A. By mixing the gelatine solution with potassium bichromate and conducting the preparation in general in a non-actinic light. 4. How is the best silvering solution made, and how many grains of silver nitrate are in one ounce of a 20 grain silver bath? A. For wet plates use 20 grains nitrate of silver to one ounce of water; for sensitizing paper use 30 grains to 1 oz. of water for wet weather, up to 60 grains for cold weather; rain water or distilled water must be used, and the solution should be sunned until all organic matter is precipitated, and then should be filtered through cotton. 5. How is the silver and gold taken out of their solution in photography? A. The salted gelatine paper precipitates silver chloride in its own mass. The gold in the toning solution is reduced and precipitated by the action of the reduced silver compounds on the paper.

(3798) J. M. asks the different speeds a wood-turning lathe ought to run to turn the following work: a column 8 in. diameter, a wheel 3 ft. diameter and a small job 1 in. diameter. A. Base all calculations on a peripheral speed of 500 ft. per minute. This is as much as the tool will stand. For the three cases cited this would give speeds of 240, 55, and 1,920 revolutions per minute approximately.

M. C. C. asks if copper can be welded without electricity.—W. A. Q. asks process for gilding frames and furniture. To oxidize brass. Cast iron cannot be soldered as stated.—F. E. J. asks how to make enamels.—G. M. R. asks how to polish cattle horns.—L. R. G. asks for a liquid India ink.—S. S. E. asks for a liquid stove polish.—T. W. H. asks how hektograph ink is made.—R. O. K. asks how to soften rubber.—F. E. M. asks for (1) liquid stove polish. 2. Razor strap. 3. Watch maker's oil.—M. B. asks for a lotion for removing pimples and freckles.—J. F. H. asks for the best formula for preparing inks for chromatic printing.—A. F. asks for receipts for paste blacking.—H. C. asks: Can you give me formula for a good liquid dressing for harness leather, also so called Levant ink for applying to ladies boots? O. B. C. asks: Will you plese send me a good receipt in a powder form for taking out iron rust? I have used salts of lemon, but it don't work in every case, and I would like something different.—J. W. R. asks how to make gelatine for plaster casts.—J. S. W. asks how to clean brass.—J. E. J. asks about aluminum solder.—J. B. C. asks how to make potato starch.—G. W. T. ask how to regild picture frames. G. W. W. asks how to etch on cutlery.—F. C. G. asks how to make white and transparent soaps.—J. B. T. asks how to remove fruit stains from clothing.—P. T. H. asks how to make rubber stamps.—B. T. asks how to color a meerschaum pipe.—E. E. A. asks how to preserve fruit.—W. B. B. asks for a receipt for making baking powder.—F. H. B. asks for a cement or paste to cement tissue paper.

Answers to all of the above queries will be found in the "Scientific American Cyclopedia of Receipts, Notes and Queries," to which our correspondents are referred. The advertisement of this book is printed in another column.

(3799) B. F. G. writes: I have some porcelain wash basins, and I want to drill two half-inch holes in the sides of them. Can you inform me through your valuable paper the easiest way I can drill them? A. You can readily drill holes in the basin by using a common drill hardened in a strong solution of chloride of zinc. The drill should be made of new steel, and should be heated to a low red before being cooled in the chloride of zinc. See the "Cyclopedia of Receipts."

(3800) S. R. S. writes: What is the name and composition of the nearest approach to the genuine diamond? A. Probably the white topax comes as near the diamond in general characteristics as anything. Special glass, called paste, is used for artificial stones, and various artifices are used for enhancing the resemblance. For further notes see answer to query No. 3717. A number of formulas for artificial jewels are given in "Scientific American Cyclopedia of Receipts, Notes and Queries."

(3801) J. E. K. asks for a good and quick way to temper cast steel or the general run of tools used by mechanics. A. See valuable information on "How to Harden and Temper Steel" in "Scientific American Cyclopedia of Receipts, Notes and Queries."

NEW BOOKS AND PUBLICATIONS.

PRACTICAL TELEPHONE HANDBOOK AND GUIDE TO THE TELEPHONE EXCHANGE. By Joseph Poole. New York: Macmillan & Co. 1891. Pp. vii, 288. 227 illustrations. Price 75 cents.

This is a manual for telephone attendants and operators, giving descriptions of the various telephonic instruments and of the central office system. It also gives information on the construction of lines, on long distance telephones, arrangement of wires for avoiding induction, and many other points which are of interest to telephone operators and users, and those who are engaged in experimental investigations in these lines.

MODERN PRACTICE OF THE ELECTRIC TELEGRAPH. By F. L. Pope. New York: D. Van Nostrand Co. 1891. Pp. xiii, 234. 185 illustrations. Price $1.50.

This is the fourteenth edition of this standard work, it having been rewritten and enlarged. It is a practical book by a practical man, which brings the literature of the electric telegraph down to the present moment, describing the more recent batteries and test instruments, theories of circuits, elements of electromagnets, modern telegraph instruments and appliances. It is a book calculated to interest the student of electricity, as well as the telegraph operator and those specially interested in telegraphy.

TESTING OF INSULATED WIRES AND CABLES. By Herbert Laws Webb. New York: D. Van Nostrand Co. 1891. Pp. viii, 118. Price $1.

This book comprises a series of practical articles which originally appeared in the *Electrical Engineer*, and found great favor among electricians. The book enters into the particulars of electric testing and explains the various tests, also the instruments used in making them. It gives instructions in making tests for insulation, tests for capacity and tests of the resistance of the conductor. It has an illustrated description of a complete lay-out of testing instruments, and examples of records and reports of tests, with specimen sheets.

THE ELECTROMAGNET AND ELECTROMAGNETIC MECHANISM. By Silvanus P. Thompson, D.Sc., B.A., F.R.S. New York: E. & F. N. Spon & Co. Pp. xx, 250. 218 engravings. Price $6.

While the name of the author is a sufficient guarantee of the value of the book, it is well perhaps to state something of the nature of its contents. The first chapter is devoted to a historical introduction, the next treats generally of electromagnets and electromagnetism, describing typical forms of electromagnets and the materials used in construction; the properties of iron forms the subject of a chapter, the principle of the magnetic circuit is explained, and the law of attraction of magnets is given; then follows a description of magnets and electromagnetic mechanism of various kinds adapted to special purposes; alternating current electromagnets receive their share of attention and motors and machine tools are also described. This is a book of great practical value to electrical engineers, electricians and students of electricity.

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December 15, 1891.

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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