SCIENTIFIC AMERICAN

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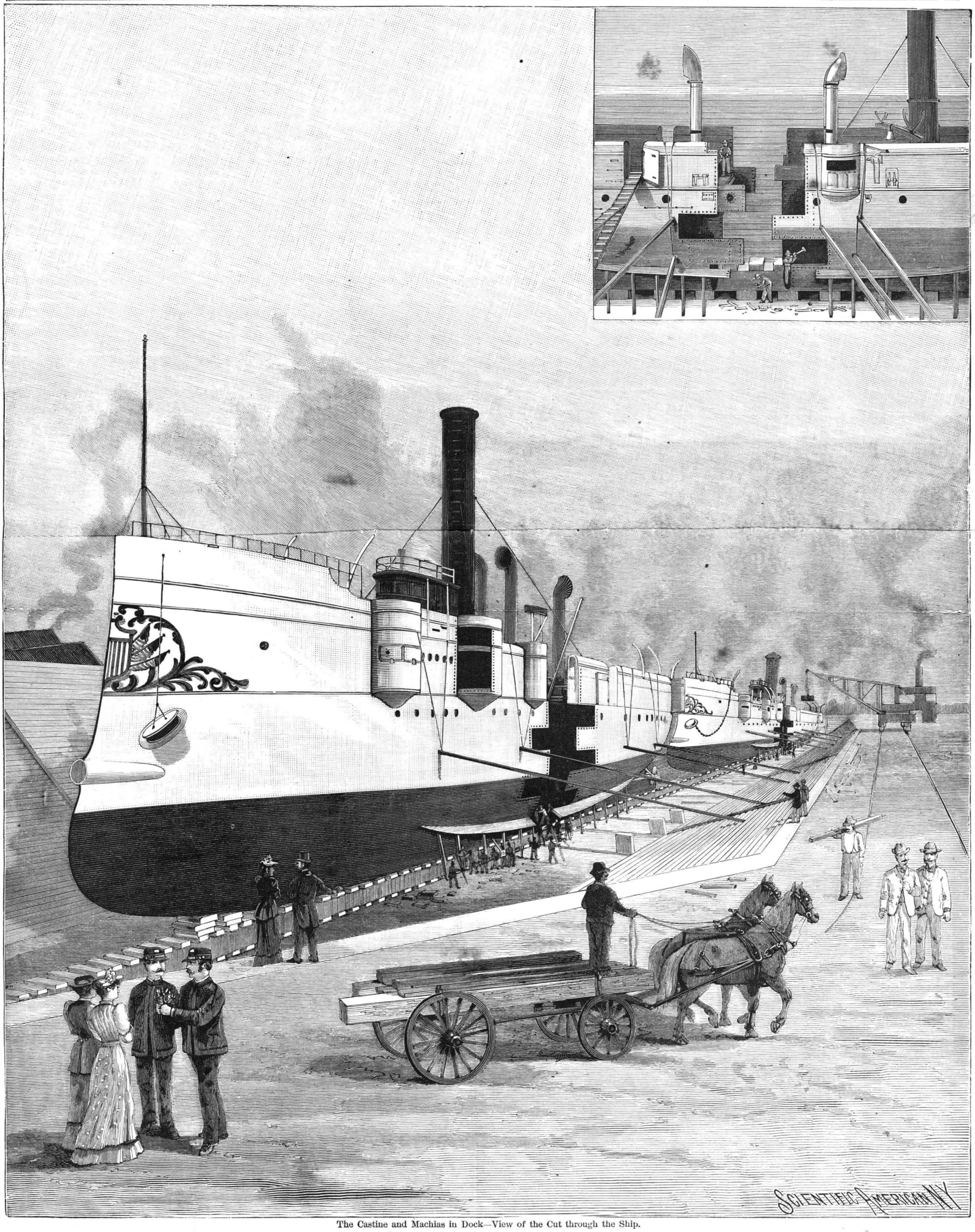

The Castine and Machias in Dock—View of the Cut through the Ship.

LENGTHENING OF THE GUNBOATS MACHIAS AND CASTINE.—[See page 7.]

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 966.

For the Week Ending July 7, 1894.

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THE STABILITY OF WAR SHIPS.

The modern war ship is a very composite affair. The vessels of Nelson were primarily ships, and were provided with cannon to enable them to fight. There was no idea of making the gun determine the quality of the hull and of adapting all particulars of construction to the efficiency of the whole as a fighting machine. One of the first instances of doing this is found in the old mortar-boats of the days of Louis XIV. and invented during his reign. These are spoken of by Voltaire, in his famous life of that monarch, in terms which show that the author realized that the mortar-boat was merely a platform for the piece of ordnance which it carried. This view of the functions of a special war ship is now more widely applicable. The modern naval vessel must be constructed with a view to providing the best possible gun platform. Her stability and her rolling qualities must be adapted to this end, as far as consistent with her uses as a ship.

These views have given a special value to determinations of the stability of ships. The heeling test has been applied to many of our naval vessels to determine the location of the center of gravity, which, in connection with the metacenter, controls not only the stability, but, what is of equal importance, has a great effect upon the rolling period. A ship of high stability, one which might be considered of exceptional safety, is liable to be so bad a roller as to be uncomfortable and a very poor gun platform. Even in the case of sailing vessels, too great stability brought about by the depression of the center of gravity is regarded as dangerous. The quick return in the rolling motion threatens the safety of the spars and strains the hull. A load of pig iron or of rails stowed too low has imperiled or foundered many a ship, because it gave too high a factor of ultimate stability. Initial stability, as brought about by a flat light-draught model, with high center of gravity, makes a ship easy in her motions. But too high a center of gravity gives a dangerously low critical angle, or angle of vanishing stability, as it is termed; in other words, the angle at which the ship would capsize becomes too small.

The naval constructor therefore stands between two fires. If he makes his heavily weighted ship, with most of her side armor, protective deck, and part of her coal bunkers, perhaps, above the water line, of high initial stability and of easy rolling qualities, she may be a good gun platform, but a very unsafe one. The filling of a single compartment with water might suffice to overturn her. Then if the center of gravity is too much depressed, her violent motions in a seaway would render gun practice from her decks very uncertain.

The monitor type of ship presents a curious combination. A vessel like the Miantonomoh may have a very high meta-center, and be of really exaggerated stability, but in a sea-way the ship is more under water than over it and is supposed to suffer much less from rolling than would a vessel of high freeboard.

The object of the heeling test as applied to a ship is to determine the location of her center of gravity. The position of the meta-center is entirely a matter of calculation, and is determined by computations based on the shape of the immersed portion of the ship. The displacement of the ship in tons is also a matter of calculation and is based on the same data as is the other. Now the stability of a ship at any given angle of heel is determined by the weight of water displaced acting upward at a distance from the vertical axis of the hull determined by the height of the meta-center above the center of gravity. The heeling test gives this distance by determining the position of the center of gravity of the ship.

The ship is placed in still water, preferably floating in a dry dock. A plumb-bob with graduated arc beneath or back or it is established on her deck. A known weight is now placed on her deck to one side of the central axis, and the angle of inclination produced thereby is read from the scale beneath the plumb-bob. The weight is shifted outward, and a second reading of the increased angle is taken. Then the weight is moved back and controlling readings are obtained. The maximum inclination given need not exceed two degrees. The weight being known and its distance from the center of the ship being known, the wanting data are supplied for determining the position of the center of gravity.

An interesting variation on this method has been applied. A steelyard has had its weight-hook attached to the sponson of a ship. Its fulcrum hook was connected to a powerful steam crane. A lifting strain was then applied and its intensity was determined by weighing it upon the steelyard. In this way the desired factors were obtained.

The decreasing of rolling in ships is really a very important problem. In passenger ships it is merely a matter of comfort to those carried. It is secured by low meta-center or high center of gravity. So little sail is now carried that stiffness, almost necessarily coupled with bad rolling qualities, is not required, as in the old sailing ships. The whole subject is a curious and interesting one, and has received a practical illustration in the lengthening of the two gunboats, Machias and Castine, to increase their stability.

Trial of the Sandy Hook Search Light.

The monster Schuckert search light, which was mounted on the Manufactures building at the Columbian Exposition of last year, was purchased by the government and erected on a tower 150 feet high at Sandy Hook, N. J. We illustrated this search light in our issue of September 2, 1893, and the tower is shown in one of the illustrations of rapid fire guns in issue of June 30, 1894. The test of the search light began June 26, to determine the practical value of search lights for coast defense and for signaling purposes. The trial will be continued for a week.

The top of the apparatus stands 8½ feet above the platform, and the diameter of the projector is 5 feet. The mirror, which is of silvered glass, has a clear working diameter of 5 feet, with a thickness of about ⅞ of an inch. It is carefully ground and polished on both sides, the labor requiring over five months for its completion. The back of the mirror is provided with a heavy coat of silver protected by a specially prepared paint. The training of the projector can be effected either by hand or by means of the electric motor placed under its base. When the electric motor is used, it can be operated from any distance.

The lamp used in the projector requires a current of 150 amperes at 50 volts, and consumes about 10 electrical horse power. The surface intensity of the light in this mirror is 194,000,000 candle power. The carbons may be adjusted to project either a convergent or a divergent beam, moving them inward toward the mirror producing the divergent beam and moving them in the opposite direction producing the convergent beam. The average intensity of the rays received by the mirror is 45,600 candle power, and the mirror takes up a beam having an angle of 140°. This angle includes the most intense rays, which lie between 40° and 60° from the normal.

The tests showed that messages could be transmitted a distance of seventeen miles with great ease, messages being communicated to local forecast official Elias B. Dunn, on the Equitable building in New York. Boats in the channel near the Hook were shown up plainly. Tests regarding the distance to which the light can penetrate will be looked for with interest.

The Berliner Patent.

Arguments were begun June 14 before Judge Carpenter in the United States Circuit Court, at Boston, in the suit of the United States government to annul the Berliner patent of the American Bell Telephone Company. The *Electrical World* says: The bill of complaint states that Emil Berliner, of Germany, filed in the Patent Office at Washington on June 4, 1877, an application asking a grant of letters patent for certain improvements in combined telegraphs and telephones alleged in said application to be invented by him. The application rested in the Patent Office until November 17, 1891, or about 14 years after the application was first filed, and the patent was granted on that day, but to the American Bell Telephone Company as assignee of Emil Berliner.

The United States contend that the Bell Company controlled the Berliner patent during this period before the issuing of the letters patent, and that it made no attempt to secure the letters patent in that time, which was probably due to the fact that it was enjoying the privileges of the Bell patent, which controlled the electric transmission of speech. It is charged that the patent was unlawfully obtained and issued by the Commissioner of Patents, and is an illegal grant and ought to be annulled, for reasons, and further, as an act of duty and justice toward the citizens of the United States, whose rights and privileges are unlawfully and unjustly abridged by the Berliner patent.

A Cheap Mushroom Bed.

According to the *Musée des Familles*, the following is a very simple and cheap method of preparing a mushroom bed that will yield a crop all the year round.

In a pine box about twenty inches in depth, and three feet square, place a four inch thick stratum of a mixture of three parts of dry cow manure and one part of garden soil. Having procured some mushroom spawn, break it up and sow it in a second stratum of manure and earth two inches in depth. Slightly compress the whole and cover with an eight inch layer of earth, which should be kept damp by watering through a fine rose.

In six or eight weeks the first crop of mushrooms will appear at the surface, and will continue to do so for at least two years, provided the bed is kept damp.

A small quantity of aqua ammoniæ added to the water with which the bed is moistened will hasten the appearance of the fungi.

The box should be placed by preference in a place where the light is not too bright, say in a cellar in which the temperature is moderate and equable, or in a dark part of a stable.

Dust in Nature.

Without dust there would be no blue firmament; the heaven would be blacker than we see it on moonless nights. On this black background the glowing sun would shine out sharply, and the same sharp contrast of intense light and deep shadow would characterize the surface of the earth. There would be nothing to subdue this sharp contrast but the moon and stars, which would remain visible by day. The illumination of the earth would be similar to that which we observe when looking at the moon through a telescope; for the moon has no atmospheric envelope, and, consequently, no dust in suspension. It is due entirely to the dust that we enjoy our soft, uniformly diffused daylight, for which our eyes are specially adapted; and it is the dust which contributes so much to the beauty of the landscape. But while the foregoing explains how the dust makes the whole vault of heaven light, it does not explain why it is chiefly the blue rays of the white sunlight that are reflected, and only to a small extent the green, yellow and red rays. This is dependent on the size of the dust particles. It is only the finest of them that are borne by the air currents into every stratum of air, and it is only these fine, widely diffused dust particles that are of any significance in this connection. Now, let us consider the mechanism of light and the extreme shortness of the ether waves which constitute its essence. These waves, although all microscopically small, vary considerably in length. The fine atmospheric dust includes many particles large enough to reflect the short blue ether waves, fewer particles capable of reflecting green and yellow, and still fewer large enough to influence the long red ethereal waves. The red light, consequently, passes through the great majority of the dust particles comparatively unhindered; the blue rays on the contrary, are intercepted and diffused, and so become visible. This is the reason that the finest dust—and so, too, the firmament—appears blue.

So, then, the finest dust appears blue. You may observe that the wreath that curls upward from the burning end of a cigar is blue, while the smoke drawn through and exhaled is whitish. The particles in the latter case have united and become large enough to reflect white light. So, too, in the country, on a clear day, the sky is blue; but in the city it appears whitish, because of the greater number of coarse dust particles in the air. It is especially on mountain heights that the sky is so intensely blue, because the rarefied atmosphere supports only the finest dust particles. At great height the sky would be almost black, if there were no dust particles in suspension. We see it grow pale as we turn our eyes to the lower strata of air toward the horizon. But why is the sky in Italy and in the tropics so much deeper blue than with us? Is the dust finer there? As a fact, it really is. Not that finer dust rises there; but in our climate the dust particles are soon saturated with water vapor, which makes them coarser. In warmer regions, however, the vapor retains its watery character and does not condense on the floating dust. It is not until the aerial currents have borne it to higher and colder regions that it is condensed to clouds.

This brings us to the most important role played by dust in our atmosphere: its influence in determining rainfall, due to the fact that vapor fluidifies upon the dust particles. It may be accepted as beyond question that of all the water evaporated by the sun from the surface of land and sea, not one drop returns which has not condensed upon a particle of dust as a nucleus. This is easily demonstrated. We fill a large flask with air which has been filtered through cotton waddings until all the original dust is driven out and the flask is full of dustless air. Into this dustless air turn a current of steam from a kettle and you will find it transparent, and, therefore, invisible. Not a trace of the cloudy appearance we associate with steam. The only thing noticeable is that the inner walls of the flask begin to drip; the vapor condenses here as it cools, because there is nothing else for it to condense on. But blow ordinary dust-laden air into the flask and the vapor at once assumes the familiar cloudy appearance due to its condensation on the dust particles, and it begins to rain in the flask. The reason for this is that the vapor condenses on the dust particles and freights them until they sink as rain drops.

Without dust, then, we would have no fog, no clouds, no rain, no snow, no brilliant-hued sunsets, no cerulean sky. The surface of the earth itself, the trees, the houses, along with man and beast, would be the only objects on which the vapor could condense, and these would begin to drip whenever the air was cooled sufficiently. In winter everything would be covered with a crust of ice. Our clothes would become saturated with water condensing upon them. Umbrellas would be of no avail. The vapor-laden atmosphere, moreover, would penetrate to our rooms and condense upon the walls and furniture. In short, the world we live in would be quite another world if there were no dust. Since scientists began to realize the important part played by dust in the economy of nature, measures have been taken to count the particles in a given space. In London and in Paris at the surface a cubic centimeter has been found to contain nearly a quarter of a million particles. On the top of the Eiffel Tower there are about half as many, while in the high Alps there are only about two hundred particles to the centimeter. A great deal of the dust at high altitudes is cosmic dust, consisting, like the meteorites, of carbon and iron.—*Die Gartenlaube (Leipzig).*

Ocean Meadows.

Out in blue water, poised on the surface of thousands of fathoms of sea, the traveler finds it hard to realize that he is crossing a meadow of plants, evading observation as individuals, and even, under ordinary circumstances, inconspicuous in the mass, yet everywhere present, affording nutrition to minute forms of animal life, which in turn supply the food of shoals of fishes. The study of these ocean meadows and of the animal life that they support suggests a variety of questions which are of practical and economic, as well as theoretical or scientific, interest. They are the feeding grounds of fishes; they open out fields of inquiry to naturalists; they offer difficulties to students of geology; and the validity of evolution demands an explanation of the problems connected with their appearance.

One of the most interesting directions in which science has recently advanced is exhibited in the records of the existence of a flora and a fauna of universal occurrence in the most inhospitable wastes of the sea. The phosphorescence, or luminosity, as it is better termed, of the ocean is well known to be due to the presence of organisms in it in vast numbers. This phenomenon, almost as brilliantly exhibited on our western coasts as in tropical seas, has at all times attracted notice; but the conditions of its exhibition are even now imperfectly understood. From the earliest times to the present there are direct and indirect records of the occurrence of transient phenomena of a like kind to be seen in the open light of day.

Many speculations have been hazarded as to the origin of the name of the Red Sea. Herodotus helps us merely to the name, and Pliny begins, as was to be expected, the work of mixing matters, having collected idle tales about King Erythras, the reflection of the sun's rays, the color of the sand, and the nature of the water. Montaigne, in his memoir on the subject, assigned the true origin of the name to the periodical occurrence in its waters, and in the tropical Indian Ocean as well, of floating banks of a microscopically minute seaweed, *Trechodesmium erythræum*. Ehrenberg and others had previously witnessed and commented on the fact, and Candolle had described a similar reddening of the waters of the Lake of Morat, owing to the presence, in extraordinary abundance, of an allied organism. Captain Cook, Hinds in the voyage of the Sulphur, Darwin in the Beagle, and many other observers, have noted similar phenomena in widely distant seas, and have, some of them, remarked the offensive odor accompanying such manifestations. Visible occurrences such as these are probably much more common in the ocean than is supposed, and an inquiry into their mode of origin leads us to the facts that such organisms do ordinarily exist at all places in the sea, and that it is merely under the most favorable conditions that we observe this sudden increase in the numbers of particular species.

Those who knew that the whole bulk of animal life in the ocean must be directly and indirectly dependent on the vegetation of the ocean were puzzled for many years by the difficulty of accounting for the apparent disparity of their volumes, since the marine vegetation of the coasts alone is manifestly insufficient to preserve the balance. The least observant eye notes that, on the great carpet of green which covers the earth, the animal life is but a faint pattern; in the ocean the proportion seems to be reversed. Owing to the action of sea water in intercepting light, which is necessary for the nutrition of all plants except parasites, there is complete darkness below 700 fathoms or less; but long before this depth is reached the quality of light in relation to its action on plants is so profoundly modified that marine vegetation penetrates to a trifling depth. On the other hand, the marine fauna ranges into the great depths, and the impossibility of balancing a mere fringe of vegetation along coasts, plus floating Sargasso banks, against the animal life of the whole ocean was apparent to all who considered the matter. The balance has been adjusted by the discovery of a ubiquitous marine vegetation, causing the tropical seas to glow with phosphorescent beams, and discoloring polar ice where the sea breaks on it. The existence of these meadows of plants is made plain to us by the direct evidence of tow-netting the upper layers of water with fine silk nets, when their capture, together with the minute forms of animal life that live upon them, is effected. The minute animal life in turn furnishes food for shoals of fishes, and the importance of an inquiry into the whole life history and seasonal occurrences of such organisms—the basis of the nutrition of marine life, as green plants are of terrestrial life—can scarcely be overrated.—*Quarterly Review.*

Science Notes.

Preservation of Wood.—A new process for the preservation of wood, says *Le Genie Civil*, has recently been made known by Dr. Zironi, of Zurich. It consists in heating the wood, say by means of a worm, in a closed vessel in which a vacuum is created. The heating is done in a vacuum in order to extract the sap that fills the pores of the wood. After this has been effected, a solution of resin in a hydrocarburet is introduced into the vessel. After the wood has become saturated, the liquid is drawn off, and a jet of steam is introduced. This removes the solvent, while the resin remains in the pores of the wood, which, through this process, undergoes a great increase in weight.

A Toluol Thermometer.—Mr. R. J. Grosse, says *Die Natur*, has just registered a trade-mark in Germany for a new thermometer in which toluol is substituted for the mercury and alcohol that have been employed up to the present. The advantages of such substitution are claimed to be many. In the first place, toluol is a liquid of a deep black color, which renders the column very visible; in the second place, the freezing point of this liquid is very remote from its boiling point; and, finally, it costs less than mercury, and the manipulation of it is attended with no danger to the health of the workmen.

Coating to Render Cement Acid Proof.—According to the *Journal des Inventeurs*, a very good acid-proof coating for cement may be obtained by intimately mixing pure asbestos in an impalpable powder with a thick sirupy solution of commercial silicate of soda as alkaline as possible. The asbestos is first brayed with a small quantity of silicate, so as to obtain a paste analogous to colors ground in oil, and that may be preserved in a closed vessel. Subsequently, it is only necessary to thin this paste with a new quantity of dissolved silicate in order to obtain a sort of paint, of which two or three coats applied with a brush protects the surface of reservoirs, etc., against any acid in the form of either liquid or acid. This liquid may also be used to form a mortar for sealing blocks of sandstones.

The Rifle Balls of the Future.—The reduction of the caliber of guns is necessarily accompanied with a diminution in the weight of the projectile. The length of the latter, in fact, cannot exceed a certain limit, beyond which it would no longer have sufficient stability in its trajectory. It would therefore be of considerable interest to have at our disposal, for the manufacture of rifle balls, a metal of reasonable price and heavier than lead. One of the metals upon which hopes may be founded, remarks the *Revue d'Armes Portatives et de Tir*, is tungsten. This metal, which is almost as hard as steel, has a density varying from 17 to 19·3, say one and a half times that of lead. By reason of such qualities, balls of tungsten, of equal dimensions, possess a power of penetration much greater than that of lead. Thus, a tungsten ball penetrates a steel plate 3 inches in thickness at a distance of 650 yards, while a similar one of lead penetrates a 2¾ inch plate at 325 yards only. The present obstacle to the use of tungsten is its relatively high price, but there are indications that this will soon be lowered to reasonable figures.

Factitious Rum.—The ingenuity displayed by certain manufacturers in the production of factitious substances designed for the human stomach is well illustrated in the case of rum, which is, or should be at least, the product of the distillation of sugar cane molasses after fermentation. Good rum, however, is rarely sold without being diluted with water and alcohol, the latter often of poor quality.

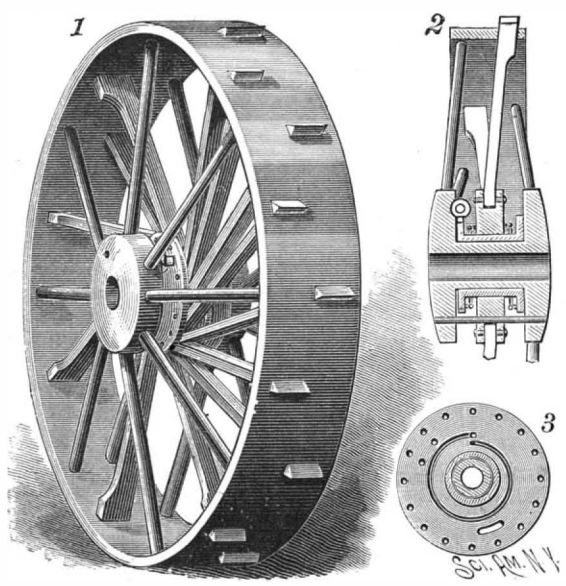
According to the *Revue Mensuel* of the Ecole de Physique et de Chimie, the flavor indicated by the label on the bottle is given by means of formic, butyric and acetic ethers. In many cases the liquor is composed entirely of water and pure spirits, with the addition of prunes, cloves and tar, substances capable of giving a color pleasing to the eye, and, finally, of raspings of tanned leather, which communicate an aroma that is particularly relished by the consumer. Infusions of raisins, carob, oak bark, catechu and caramel may serve the same purpose. Things are so managed that the final degree of the liquor shall be 52.

Clapboards.—The name "clapboard" for a thin, narrow board used to cover the sides of houses, and placed so as to overlap the one below, has been supposed to be an Americanism, but, like many other alleged Americanisms, it was brought over to this country by the early English colonists. According to very old dictionaries published in England, clapboards were thin boards formed ready for the cooper's use, for the manufacture of casks. They were originally *cloveboards*, because they were "cloven" out by hand, and not made with a saw, as other boards are. In course of time, the word was abbreviated to *cloboards*, *claboards* and *clapboards*.

In the laws of Massachusetts Colony, in 1641, the price of these articles was three shillings for *claboards* five feet in length. The legal price for the work performed by hired labor was: "If they cleave by the hundred, they shall be paid six pence per hundred for five-foot boards."

A TRACTION WHEEL FOR HARVESTERS, TRACTION ENGINES, ETC.

In this wheel the projections of the rim are yieldingly held, or they may be withdrawn entirely from the surface or held locked in outermost position. The improvement has been patented by Messrs. Sylvester Warner and Owen E. Cook, of West Union, Ind. Permanent spokes connect the rim with outer and inner flanges of the wheel hub, while a sleeve fitted loosely on the hub between the flanges carries a loosely rotating wheel on which are pivoted the inner ends of slidable arms, whose outer ends are beveled and pass through openings in the rim, as shown in Fig. 2. The

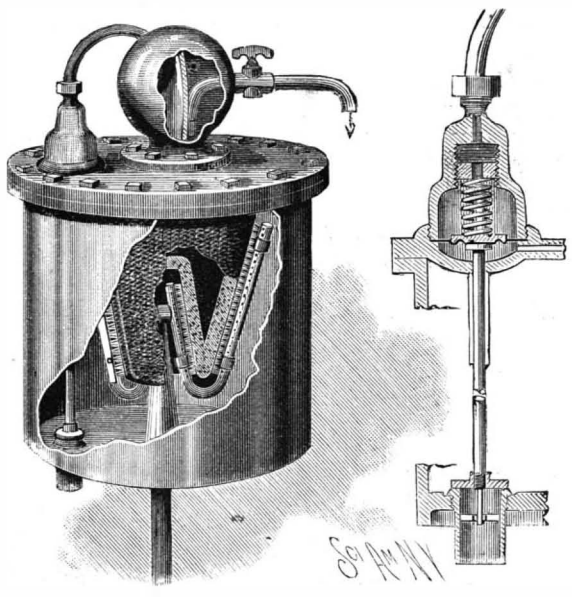


WARNER & COOK'S TRACTION WHEEL.

opposite faces of the wheel on which the arms are pivoted are connected with coil springs fastened on the flanges of the sleeve, as shown in Fig. 3, making a yielding connection between the wheel and the sleeve, whereby the sliding arms will normally be held in outermost position, but in traveling over hard ground the projecting ends will be forced inward. One flange of the sleeve has teeth engaged by a worm on a shaft in bearings attached to one of the hub flanges, and this worm shaft may be conveniently turned by a wrench to move the sleeve so as to tighten or loosen the springs, also locking the sleeve in place. To fasten the sliding arms in either an inner or outer position, a pin is passed transversely through apertures in the hub flanges and through one of several apertures in the wheel on which the sliding arms are pivoted, the wheel being turned to the proper position before inserting the pin, while the passing of a pin through the hub flanges and an elongated aperture in the wheel restricts the latter to a limited turning in either direction. The improvement is designed to afford proper traction over all kinds of ground for the machine on which the wheel is employed.

AN AUTOMATIC SELF-CLEANSING WATER FILTER.

The filter shown in the illustration is designed for use where the water is supplied under pressure, as in



LYNN'S AUTOMATIC WATER FILTER.

its service from the mains of a city water works, and its construction is such that it is self-cleansing and automatic in its action, without the necessity of removing or handling any of its parts. The improvement has been patented by Mr. Elmore P. Lynn, of Cincinnati, Ohio. The filter proper is a tight metal vessel, and, as shown, is cylindrical, with a spherical chamber at its top divided into two compartments, the spherical chamber being united to the main vessel by bolts, which also hold up a frusto-conoidal filtering chamber of porous earthenware centrally in the filter. The filtering chamber has a frusto-conoidal cavity and a neck on its upper end engaged by a packed collar into which the bolts are screwed. In the center of the bottom is a tubular boss, in which is the water supply pipe, and journaled in this boss is a hollow sleeve having a horizontal pipe on its upper end, to which at each end is attached a pipe bent to conform to the shape of the earthenware filtering chamber. These pipes have perforations at an angle to the surface of the filter chamber, directing entering water against it, and thus causing the rotation of the pipes, the latter also carrying brushes in close proximity to the surfaces of the filter chamber. At the bottom of the main chamber, at one side, is an exit pipe for impure water, closed by a valve whose stem passes up through a sleeve into a chamber at the top, as shown in detail in the sectional view at the right.

The upper end of the valve stem is secured to a diaphragm with a disk held down by an adjustable coiled spring, normally holding the outlet valve closed. The tension of the spring is regulated by a hollow nut, and the upper end of the chamber communicates by a pipe with the filtered water discharge compartment of the spherical chamber at the top of the filter, while a port connects its lower part, below the diaphragm, with the other compartment of the spherical chamber, which is for both water and compressed air. The entrance to the exit pipe for filtered water is restricted by a bush to maintain, with the valve open, a certain proportionate lower pressure in the discharge chamber as compared with that in the lower chamber. With a pressure from the mains of forty pounds and a pressure in the discharge chamber of twenty pounds, with the cock open, the pipes carrying the brushes will be slowly revolved around the filtering chamber. The pressure in the other half of the spherical chamber will at the same time equal that in the lower portion of the filter, and the valve closing the outlet for impure water will be held down by the spring, aided by the pressure upon the diaphragm through the pipe connection with the discharge opening. But with the clogging of the filtering material by impurities, the diminished passage of water and the lowering of the pressure in the discharge chamber, the spring ceases to hold down the diaphragm, and the valve at the bottom is opened. This immediately removes all pressure in the lower chamber, and the pressure of the water entering from the mains causes an accelerated movement of the pipes and brushes and forces them into close contact with the surface of the filtering chamber to effectually clean it. The pressure in the discharge chamber also causes a reversal of the current through the filtering medium, the pressure in the compressed air and water chamber meanwhile falling slowly by the escape of water through the small port discharging under the diaphragm, until the force of the spring overcomes this pressure and closes the valve at the bottom, the surface of the filtering medium having been effectually cleaned during the time between the opening and closing of the valve.

Ice from Natural Gas.

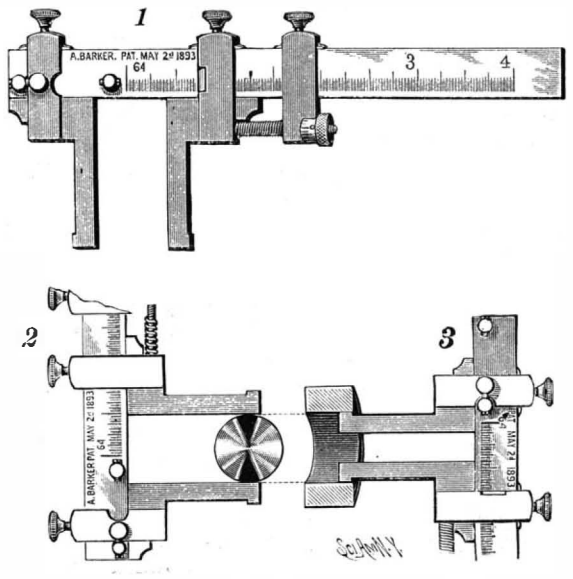
It is probable that, before the natural gas supply of certain parts of the United States is exhausted, this gift of nature will be better utilized than has hitherto been the case. Indeed, it would not be surprising if the advantages of the natural gas supply were only to become fully appreciated just before it ceases for ever. It appears, from a recent contribution to an Indianapolis newspaper, that a local firm have constructed a refrigerator for making ice by means of the cold produced by the expansion of natural gas to atmospheric pressure. This is the principle of all artificial ice machines; yet it seems to have only just occurred to some American engineers that natural gas as it issues from the wells at pressures amounting in some instances to 20 atmospheres, and at a temperature of 42° Fah., presents the sole physical condition necessary for the production of cold by gaseous expansion. Assuming the density of the gas to be only half that of the surrounding air, 1,000 cubic feet of it will weigh 38·5 pounds.

According to Pictet's formula, by expanding a gas from a pressure of 20 atmospheres to that of 1 atmosphere, its temperature would be reduced 318° Fah. below freezing; and by expanding 1,000 cubic feet of gas per minute, there would be a cooling effect of 318° × 38·5 pounds, which would make 72 pounds of ice per minute from water at 62° Fah. Hence a very ordinary gas well, supplying 1½ million cubic feet per diem, is theoretically capable of producing 51 tons of ice daily at a cost of not more than 50 cents per ton; and, after all, if delivered in its expanded state to furnaces, etc., the gas would produce, on burning, as much heat as if it were delivered for fuel direct from the well. Hence, by proper management, the natural gas supply of Indiana and Ohio should supply all the ice wanted by these States during the hot season, as it actually furnishes most of the heat required all the year round.—*Journal of Gas Lighting.*

It would require 12,000 cholera microbes to form a procession an inch long.

AN IMPROVED CALIPER.

This is a combined inside and outside caliper, with graduated beam and micrometer attachment, which at once and accurately transfers distances from outside to inside or inside to outside. It is designed to afford a first class tool for machinists, and one which does not call for special skill in its use. Mr. J. F. Getman, of Richfield Springs, N. Y., is the sole agent for this tool. It will caliper work from one-half inch to three inches in diameter, making tight or loose fits, and varying the fit by one-thousandth of an inch. The micrometer screw has 50 threads to the inch and the graduated nut has 20 graduations, so that by turning the nut one degree it will move the right hand jaw one-thousandth of an inch, or by turning the nut half round, or ten degrees, it will move the jaw one-hundredth of an inch (when of course the bind-

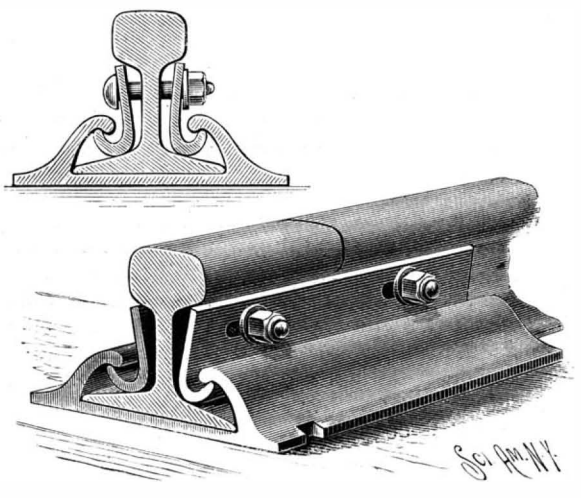


BARKER'S PATENT BEAM CALIPER.

ing screw is loosened and the one on the nut clamp tight), making the fit tight or loose by that amount, depending on which way the nut is turned. The beam is graduated in 64ths and 50ths of an inch. To transfer measures from outside to inside, or inside to outside, it will at once be seen by the above cut that the left hand jaw slides on the bar between two posts which have adjusting screws, so that the movement of the jaw between them is just the combined width of the feet of the two legs; therefore if the left hand jaw is set against the outside post and a shaft or piece of work is calipered outside (as in Fig. 2), and the jaw loosened and moved against the inside post, you will have the exact size of a hole to fit it, as in Fig. 3. The reverse of this operation will caliper a hole to fit a plug or shaft (see Fig. 3). The changes can be made almost instantly without looking.

AN IMPROVED RAIL JOINT.

This improvement, patented by Dr. M. O. Perkins, dentist, of Galveston. Tex., is designed to be a complete automatic rail joint, operating efficiently, also, as a nut lock. The rails to be joined are embraced by a chair and spring side plates, the latter being fastened together and to the web of the rail by bolts, as more plainly shown in the small sectional view. The side plates are made of spring steel, and are so shaped and engaged in the chair that when the nuts are tightened the rails are pressed to the bottom of the chair, and the chair is drawn up to the bottom of the rails. The spring tension thus acts to recover all wear, and the plates press continually against the backs of the nuts, thus completely locking them. It is claimed by the inventor that after this joint is once properly placed it will not need readjusting.

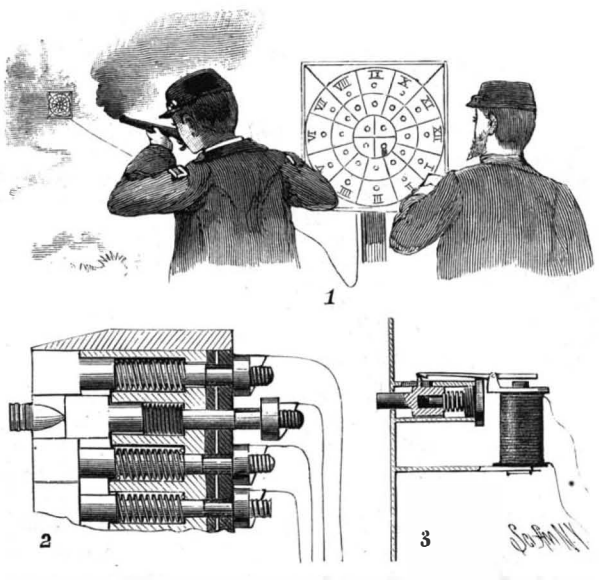


PERKINS' RAIL JOINT.

A DWELLING AT SPRINGFIELD, MASS.

Our illustration represents an admirably planned and picturesque residence, recently erected for Mrs. Samuel Woods, on Armory Hill, at Springfield, Mass. On all sides of the building there are many bits of detail that are of interest, especially the bay windows and tall chimneys, which are an architectural feature in themselves. The under-pinning and all stone work shown in the engraving is built of rock-faced sandstone of a reddish brown color; the remainder of the building is sheathed, papered and covered with cedar shingles, and stained a reddish brown. The western gable is carried out in the "Old English" half-timbered style, with the panels filled in with stucco work. Roof is covered with shingles and stained sienna. The building has an extreme frontage of 55 ft. 10 in. by a depth of 66 ft. 3 in. The cellar is 8 ft. in height, while the first story is 10 ft.; second, 9 ft.; third, 8 ft. 6 in. Vestibule, trimmed with quartered oak, has a large "Dutch" door, filled in with beveled plate glass. Hall is trimmed with similar wood. It has a paneled wainscoting and ceiling beams, forming deep panels. The staircase is a very handsome one, built of quartered oak. It has a massive carved newel and an octagonal projection thrown out at first landing, with windows glazed with delicate tinted glass, shedding a soft and pleasant light over upper and lower halls. The fireplace has a massive oak mantel, with hearth and facings of Anderson brick. Reception room, trimmed with cherry, is separated from hall by Colonial columns extending to ceiling, with carved capitals, etc. Drawing room is trimmed with red mahogany. It has a large bay window with seats, and a fireplace built of Tiffany brick and furnished with a mantel of excellent design. Dining room is large, well lighted and provided with a buffet carved in an exquisite manner, and a mantel of English oak extending to ceiling. This dining room has also a paneled wainscoting and ceiling beams. The floors are of oak and are highly polished. Rear hall and servants' staircase is a private one from cellar to third floor. The butler's pantry has a counter shelf of Italian marble and other shelves inclosed by glass doors. Kitchen and its apartments are wainscoted and trimmed with white wood, finished natural. There are five bedrooms, study and bathroom on second floor. Some of these apartments are trimmed with cherry, while the others are treated in delicate colors. Bathroom is wainscoted and trimmed with ash, and it is furnished in the best possible manner. There are three large bedrooms on third floor, besides ample storage. Cemented cellar contains laundry, furnace and other necessary apartments. Mr. Francis R. Allen, architect, No. 220 Devonshire St., Boston, Mass.

Our engravings were made direct from photographs of the building, taken especially for the Architects and Builders Edition of the SCIENTIFIC AMERICAN. The number containing this view has also the elevation printed in colors and also a plan of the interior. Copies may be ordered from this office. Price 25 cents.



SCHIFFERDECKER'S TARGET AND INDICATOR.

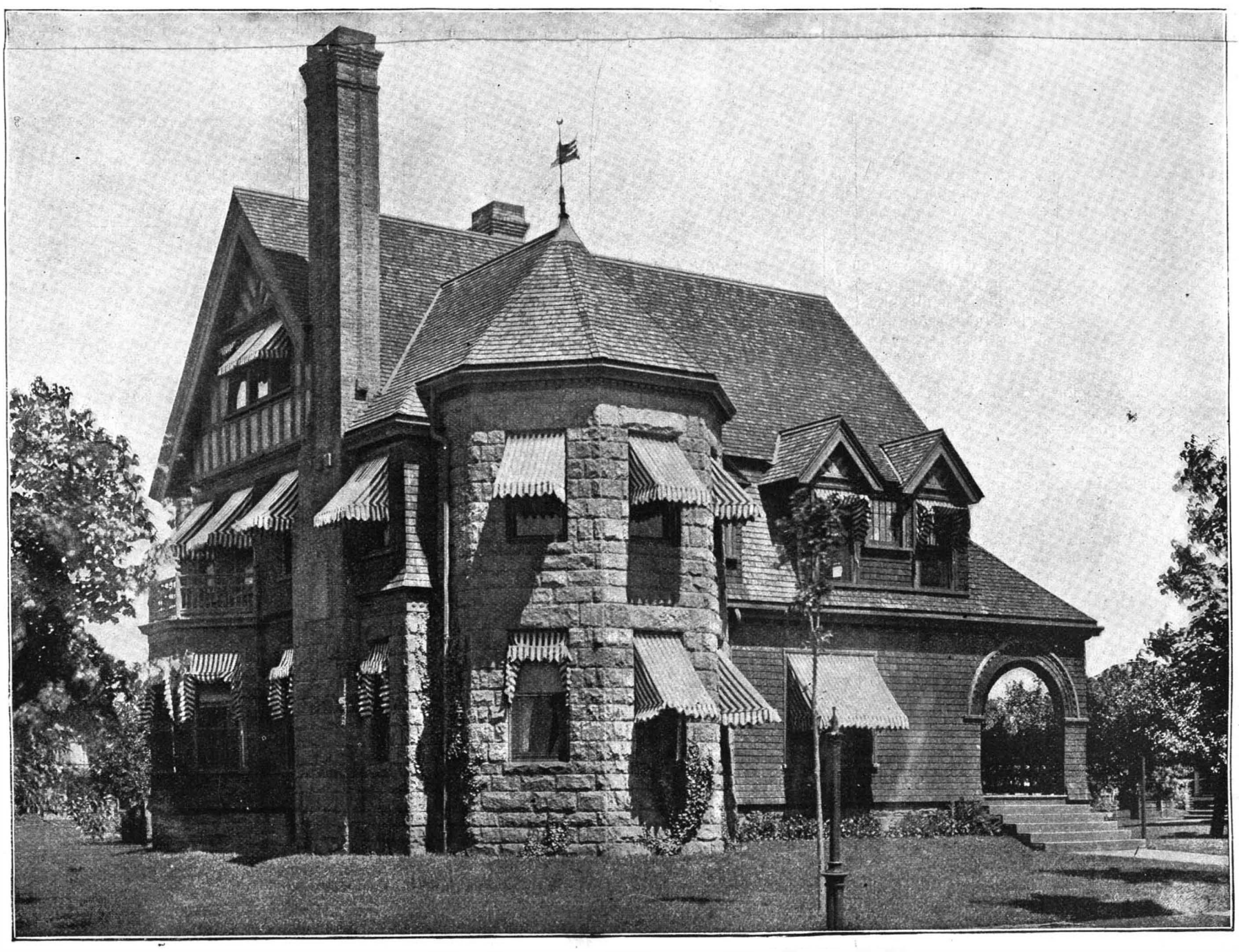
AN INDICATOR TO FACILITATE TARGET PRACTICE.

The illustration represents an arrangement whereby an indicator dial at the shooting stand is so connected electrically with the target that the exact effect of each shot may be at once seen on the dial, without the necessity of inspecting the target. The improvement has been patented by Mr. Charles Schifferdecker, of Fort Assinaboine, Montana. The target is arranged in a holding frame, and is divided into radial sections, the bull's eye consisting of four sections. These sections are filled with push buttons, which form the face of the target, and have rearwardly projecting bolts, each encircled by a spiral spring, as shown in Fig. 2. In the rear end of each bolt is a conducting plate, from which a wire leads to one pole of a battery including in its circuit one of the magnets of the indicator dial, the different wires from the target being preferably united to form a cable. The indicator dial, located near the shooting stand, is divided into sections corresponding to those of the target, and numbered consecutively from I to XII, like the dial of a clock, whereby the score of a shooter may be readily reckoned. Behind each section of the dial is a tube with a spring-pressed sliding plunger, as shown in Fig. 3, and a pointer which protrudes from the face of the dial when the plunger is released. The plunger with its pointer is normally held in retracted position by a catch on an armature lever, as shown in Fig. 3, but when the magnet is energized by the closing of the circuit, which occurs when one of the push buttons of the target is forced backward by the impact of a bullet, the plunger is released and slides forward so as to display the pointer, showing in which section of the target the bullet has struck. If desired, an electric bell may be included in the circuit, so as to ring at the same time the pointer is displayed.

Powerful Gunnery.

In a test of projectiles against old armor plates (not Harveyized) on the 23d of June last, at Indian Head Proving Grounds, some astounding results were obtained. A 13 inch Carpenter projectile, weighing half a ton, went clear through a 17 inch nickel-steel plate with its customary backing. Another, after plowing through the sand butts, against which the plate was bedded, was finally recovered unbroken, and to all intents as good as new, in the woods 500 yards away.

A Wheeler-Sterling shell of the same dimensions was also fired, under similar conditions, piercing the plate and backing and going into the butts, whence it has not been recovered; so it is not known whether it received injury. This remarkable performance of two shells, furnished by different makers, shows what a tremendous engine of destruction the United States has secured in its 13 inch gun, which has rather aptly been christened the "Peacemaker." These shells weighed 1,100 pounds each, and it is thought that the Peacemaker could drive them through the greatest battle ship ever built. The test was for the acceptance of fifty similar projectiles from each of the contractors.



MRS. SAMUEL WOODS' DWELLING AT SPRINGFIELD, MASS.

Tuberculous Cattle.

A dispatch from Washington is to the effect that, as soon as the appropriation of $100,000 in the agricultural bill becomes available, the Bureau of Animal Industry of the Agricultural Department will begin an investigation of the prevalence of tuberculosis among cattle. The investigation will be commenced among herds from which Washington itself gets its supply of milk Various herds in that section of the country have been inspected and tested from time to time, with startling results. A herd ten days ago on a farm in the District was found to have 80 per cent of its animals infected; and a few days before that no fewer than 90 animals in a herd numbering 125 near Richmond, Va., were discovered to be diseased. These are extreme and unusual cases, it is true; but occurring synchronously within a narrow radius, they were enough to rouse the government to a sense of the danger to which the country is exposed from this source. An experiment performed by one of the scientists attached to the animal industry laboratory about the same time tended in the same direction of alarm. Ascertaining from test experiments which he had been making with the milk supply of the capital that it was tainted with tubercle, though perhaps not tainted sufficiently to be very dangerous to human health, he inoculated a guinea pig with the milk; and, sure enough, after a few days, when the tubercle bacilli in the milk had had time to plant themselves and develop in his system, the rodent exhibited unmistakable tuberculosis. Concurrent circumstances like these, forced on the attention of the government, produced the belief that it was about time a general investigation of diseased cattle should be made, if the danger to human health so portended would be avoided.

The way in which cattle are diagnosed most easily and most surely for tuberculosis is by the inoculation of them with an infinitesimal quantity of a preparation of which we heard much more a few years ago than we hear now—Koch's tuberculin. Tuberculin is a pretty expensive drug, costing $8 for about a teaspoonful. The government prepares considerable quantities of it, and distributes it free among State boards of health and live stock commissioners. Inoculated with tuberculin, cattle straightway declare whether they are infected with tubercle or not, by the reaction that follows or fails to follow the inoculation. Now, tuberculin has been furnished to 23 of the 44 States of the Union; and the tests which have been returned to the government from these States, although they have not nearly all been returned yet, show conclusively that the disease is spread among cattle throughout almost the entire Union. In fact, the probabilities are that it will be found that 5 per cent of all the cattle in the United States are suffering more or less with tuberculosis!

That is the alarming state of things of which the government will have to take account, and for which it will some way or other have to devise a remedy. It cost $1,500,000 to eradicate contagious pleuro-pneumonia from United States herds, and the amount of contagious pleuro-pneumonia was not a tithe of the amount of tuberculosis which at present exists. So many milch kine alone are infected with it, says Dr. Salmon, of the Bureau of Animal Industry, that, if they be all killed, "fresh milk will cost as much as champagne." It would be well for us not to forget that of all our cattle, and especially of our milk-givers, at least 5 in every 100 are infected with tuberculosis; which disease, appearing most commonly as consumption in the human subject, is easily communicable both through meat and through milk. Common prudence would suggest the necessity, therefore, of boiling all milk before it is administered to anybody.—*N. O. Times-Democrat.*

The Press in the Arctic Regions.

There exist at present several journals that make their appearance but once a year. They are therefore not "journals" (literally, "dailies"), accurately speaking, but "annuals." These sheets are published within the confines of the north polar circle. The *Eskimo Bulletin*, for example, is edited near Cape Prince of Wales, on Behring Strait. Here, in a village inhabited by Eskimos, the English missionaries have established a school, and as but one steamer lands at this place, and that, too, but once a year, the news that it brings is consigned to a sheet of paper printed with the hektograph. Its size is 8 by 12 inches. The paper is very thick and but one surface is used. This journal, in a subhead, claims to be the "only yearly paper." This, however, is an error, for there is an annual sheet published at Godthaab, in Greenland, where a small printing office was established in 1862, whence about 280 sheets and many lithographic prints have been issued. The journal in question is entitled *Atuagagdlintit, nalinginarmik tusaruminasassumik, i. e.*, "Something for reading, accounts of all sorts of entertaining subjects." It has been published since 1861, and up to 1874 comprised 194 sheets in quarto, and about 200 leaves with illustrations. The language is that of Greenland, a dialect of the Eskimo. There is still another periodical published in Greenland under the name of *Kaladlit.*

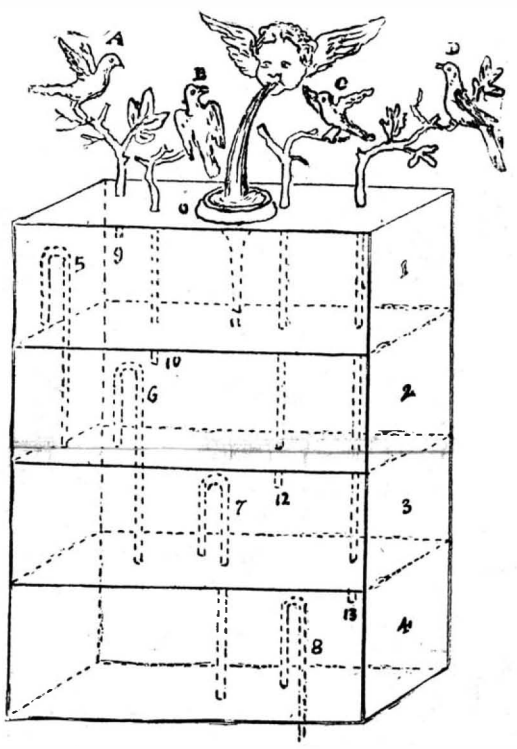
AN ANCIENT AUTOMATON.

BY W. F. DURFEE.

If a skillful mechanician of the present day should undertake to construct by the use of modern mechanism an automaton imitative of a concert of singing birds, he would doubtless turn his attention at once to some combination of bellows, pipes, reeds, pin barrels, levers, wheels, springs, and regulating flies; and would introduce a judicious mixture of cranks, cams, connecting rods, valves, and wind chests.

When finished, the result would be a marvel of mechanical skill and elaborate ingenuity. When it was "wound up," its birds would doubtless sing with such vigorous disregard of all the requirements of the science of bird music that the living songsters whose notes were intended to be imitated would feel tired, discouraged, and full of regret that they had ever been hatched. The expense of such a contrivance would be commensurate with its complexity; and, however great its success as an imitative mechanism, would prove a bar to frequent reproduction.

If the inventor of such an automaton should be told that about 2,000 years ago groups of artificial birds were made to sing equally as well as his, without the use of a wheel, pinion, lever, crank, or revolving mechanism of any kind; he, remembering the wealth of time, thought, machinery, and money he had expended, would probably dismiss the suggestion as the culmination of all that was mechanically absurd and ridiculous, and would entertain unutterable opinions of the very uncommon character of the sense of him who made it; but, notwithstanding the indignant doubts of this modern inventor, such simple and effective automata were made by the ancient mechanicians, and Hero of Alexandria has left us an account of some of them.



AN ANCIENT AUTOMATON

In his "Spiritalia" (written about B. C. 150) Hero describes several automata, of which figures of birds form a part; but perhaps the most remarkable for its ingenious simplicity is No. 44, the illustration of which we reproduce.

The description of this, as given by Hero, is somewhat meager and unsatisfactory, but the drawing is so very plain that, taken in connection with other mechanism in his work, operated in a similar way, it is easy to understand how the desired result was accomplished.

An air-tight box of metal was provided, which was divided into four compartments, 1, 2, 3, 4, by horizontal diaphragm plates. On the top of this box was a basin, O, for receiving the water of a fountain. Around this basin were four birds, A, B, C, D, perched upon branches or shrubs, which apparently grew out of the top of the box. Each of these branches was hollow, and communicated with one of the compartments already named by one of the pipes, 9, 10, 12, and 13, which passed but a very short distance through the tops of the several compartments. The bodies of the birds were also hollow, and were connected with the hollow branches by tubes in their legs. In the hollow body of each bird were two musical reeds or whistles of different note. One of these would sound when air was forced outward through the beak of the bird, and the other would only respond to air drawn inward. This alternate action of the air, and consequent variation of note, was produced by the peculiar way in which the water supplied by the fountain was made to pass through the several compartments.

The water from the basin, O, entered compartment, 1, near its bottom by the pipe, 11, and as it rose in the compartment it compressed the air above it, which escaped through the beak of the bird, A, and caused its first note to sound; but when the water reached the top of the bend of the siphon, 5, it at once commenced to discharge by that siphon into compartment, 2; but as the siphon, 5, was so proportioned that it discharged the water much faster than it was supplied by pipe, 11, the level of the water in compartment, 1, gradually fell, and the air in passing into this compartment through the beak of the bird, A, caused its second note to sound. As the water rose in compartment, 2, it compressed the air above it, which passed by the pipe, 10, to the bird, B, which then sounded its first note, while the bird, A, was sounding its second, and this state of affairs continued until all of the water was discharged from compartment, 1, and compartment, 2, was filled to the top of the bend of siphon, 6, which then commenced to discharge into compartment, 3, and as siphon, 5, had ceased to operate, the water gradually fell in compartment, 2, and the air entering by the beak of the bird, B, sounded its second note. While this was taking place compartment, 1, was again filling, and the first note of bird, A, sounding, and compartment, 3, was also filling, and the air above the water therein was being forced by the pipe, 12, into the bird, C, and causing its first note to sound.

By following out the operations described, and tracing the action of the flux and reflux of the water in the compartments, 3 and 4, it will readily be seen that the bird, C, will sound its second note when the compartment, 3, is being discharged by siphon, 7, into compartment, 4, and at the same time the bird, D, will sound its first note, and that eventually the water will escape from the automaton by the siphon, 8, causing the second note of the bird, D, to be heard.

It is evident that by simple and well known means any or all of the bird notes can be made to trill, and that it is only necessary to properly proportion the discharging capacity of the siphons to insure the repetition and admixture of the notes in a bird-like manner; and it is further evident that the employment of the ideas involved is not of necessity confined to but four birds, as several birds, each having different notes, might be operated from the same compartment, and of course as many compartments as may be wished can be used. Furthermore, the wings of the birds could be made to move, and their beaks to open and shut, by the movement of the same air which acted upon the musical reeds or whistles.

Each of the siphons in the automaton was intermittent in its action, ceasing to flow when its compartment was emptied and commencing again spontaneously when the water reached the level of the top of its bend. The antiquity of intermittent siphons is of special interest from the fact of their comparatively recent application in sanitary plumbing.

Chaucer was not much in error as regards his own time (1328–1400), and his words are only somewhat less true to-day:

> "For out of the old fieldes, as men saithe,
> Cometh al this new corne fro yere to yere;
> And out of old bookes, in good faithe,
> Cometh all this new science that men lere."

Odors of Volatile Oils.

The tendency of the results of recent investigations is to show that, instead of the characteristic odor of an essential oil being invariably due to one single principal constituent, the other bodies present have also a distinct value in determining the odor. In addition to volatile oils of which the odor is simple in character, there are others in which several odoriferous bodies combine to produce the characteristic odor. Thus the oils of caraway, anise, and linaloe are examples of those in which the aroma is due to a single odorous body—carvol, anethol, or linalool—the determination of which suffices as a test of their value and purity; whereas the conditions are more complex in the case of the oils of cassia and cinnamon. The odor of cinnamic aldehyde, the chief constituent of cassia oil, is adversely affected by the presence in the oil of cinnamyl acetate, in greater or less proportion; while in Ceylon cinnamon oil, eugenol, phellandrene, and small quantities of other compounds not as yet identified, affect the odor of the aldehyde beneficially. Though, therefore, the value of cassia oil may be directly estimated by quantitatively determining the amount of aldehyde contained in it, the same process is not applicable to cinnamon oil, in the case of which the percentage of this ingredient is only one factor in the valuation of the article. Still more complicated conditions exist in the cases of lavender, bergamot, neroli, and petitgrain oils; and rose oil affords a striking example of the important influence which combinations of odoriferous bodies sometimes exercise on the perfume. The oil of rose, geranium, and palmarosa contain approximately the same percentage (80 to 90) of geraniol, which is identical in the three oils. While, however, the last two oils are valued in proportion to the amount of geraniol they contain, the value of rose oil depends upon the various other bodies present, the investigation of which will be necessary before a scientific basis can be found for the chemical examination of rose oil.—*Schimmel's Bericht.*

THE LENGTHENING OF THE GUNBOATS MACHIAS AND CASTINE.

An interesting operation has recently been performed at the Brooklyn Navy Yard. It consisted in the lengthening of two of the new navy ships, the gunboats Castine and Machias, and we illustrate in this issue the execution of the work.

These ships were built at the Bath Iron Works at Bath, Maine, their names to some extent revealing their place of construction or native state. They are sister ships, as originally built, of 1,050 tons displacement, 190 feet load water line, 32 feet breadth of beam, and 17 feet depth from main deck. As armament each ship carries eight four-inch breech loading rifles, four six-pounders and two one-pounder rapid firing guns and two Gatling guns. The ships throughout are of American build and were designed by the Navy Department.

They were found to be lacking in stability. Each ship has a high forecastle and high quarter deck, the waist being comparatively low, with high bulwarks at its sides. Should a sea be shipped and the waist filled with water, there would be great danger of the vessel capsizing and foundering before the water could escape by the scuppers. Again, in case of war or collision, the filling of any of her compartments with water would very probably bring about the same result. Various plans of increasing the stability of these ships were discussed, and finally it was decided to lengthen them, an operation which has not been carried out in the navy yard for many years.

The two ships were accordingly docked in the new timber dry dock. Sliding ways were provided for the keels of the forward half of each ship; when floated into the dock, as each ship took its keel bearings, bilge blocks were run in as usual and the emptying of the dock was completed. The ships were now shored in place; the bilge blocks on the forward halves were drawn back and sliding ways substituted therefor. Previous to their introduction into the dock a little work had been done in cutting the ships in two, but the hull and truss elements of the ships were left virtually intact. When once in the dock and exposed, a gang of men began to cut them apart. The rivet heads were cut off, on the inside of the ships for the most part, and the rivets were backed out. In this way a division was carried all the way around each ship entirely by removing the rivets, the plates not being cut at all.

Next came the operation of separating the two portions of the ship. Wedges were driven just above the sliding ways under the bilges, so as to remove part of the weight from the keel blocks and sliding way resting thereon. Hydraulic jacks were then arranged, some within the ship and some working against the ways in the most accessible positions of advantage to push the two halves apart. An accurate system of sighting was provided, a theodolite being mounted on the quarter deck with sighting points on the forward half of the ship. The jacks were now worked, and very slowly the ship separated, and the jacks were shifted and worked again until the forward half was moved 14 feet from the after portion. In case of one of the ships absolutely no departure from alignment could be detected during the movement. In the case of the other ship perhaps $\frac{3}{16}$ of an inch of departure was observable at one time.

To complete the operation the gap had to be closed. For this purpose a complete set of plates, each one 14 feet long, were provided, and by means of the new Sellers traveling crane they were lowered in position and were then riveted into place. The plates were butt jointed and riveted to inside straps. Previous to the introduction of the plates, seven new frames had to be put in to complete the framing of the ship. On Tuesday, May 15, operations began upon the Castine, and by half past seven P. M. on Thursday the ship had been divided and pushed apart. Operations on the Machias began on Friday morning and on Saturday at one P. M. she was also divided and ready for the frames and plating.

The new ships will be 204 feet long on the load water line and will have 1,220 tons displacement. The metacentric height is increased from nine inches to nineteen. This not only adds greatly to their stability, but the increase in size will enable them to carry eighty-five additional tons of coal on the same draught as before, while the bunkers are given an increase in capacity of one hundred and twenty-five tons, which at a speed of eight and one-half knots give her nine days or about seven hundred and sixty-five miles additional radius of action, burning fourteen tons of coal per day.

The improvement in stability is due to the addition of midship section. This is the broadest and most stable portion of the ship. It is easily understood that a section of bow or stern isolated from the rest might at once upset. But the broad midship section with its exaggerated stability brings up the whole to the proper amount, and an increase in its length means an increase in the sum of stabilities of the different sections. The work was in charge of naval constructor F. L. Fernald, U. S. N.

Change of Color in Lemon and Orange Peel.

BY E. G. CLAYTON.

When orange peel is moistened with strong hydrochloric acid, its color changes from yellow to a rich dark green; lemon rind, similarly treated, retains its hue, or, at most, assumes a dingy, yellowish-brown tint. A convenient and simple chemical test, therefore, which will distinguish between small fragments of lemon and orange peel is to touch them with a glass rod previously dipped in hydrochloric acid. The diluted acid will answer the purpose, but the reaction is slower.

A few minutes exposure to hydrochloric acid gas will effect this change in the pigment of orange peel. The color of lemon rind is unaffected.

The shades of green developed by dilute hydrochloric acid are deepest in the cases of Murcia, Denia, and Florida oranges, of moderate intensity with Jaffa and "blood" oranges, and feeble with Valencia and Tangerine oranges. This statement also applies to the reactions with strong hydrochloric acid, excepting that the color of Tangerine orange peel with the strong acid is perhaps more intense than that observed with any of the other varieties of the fruit.

The peel of the lime behaves, with hydrochloric acid, like lemon rind.—*The Analyst.*

NEW STEEL BELT FASTENER.

We illustrate an improvement in belt fastenings which has just been placed on the market by W. O. Talcott, 16 Sabin Street, Providence, R. I. In the Acme steel belt hook, the teeth, being long and sharp, pierce the belt easily, and as they stand diagonally upon the hook, they do not cut away so much of the strength of the belt as they would if they cut continuous holes or slits straight across the end of the belt.

The teeth rivet toward the center of the fastener, as

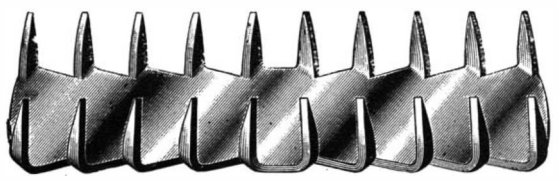


Fig. 1.

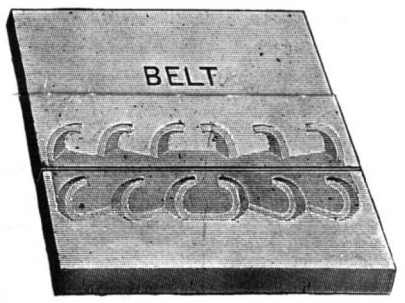


Fig. 2.

Fig. 3.

Fig. 4.

ACME STEEL BELT HOOKS.

shown in Fig. 2, giving them a very strong hold in the belt. Fig. 1 shows the hook with teeth full size, and Fig. 3 a much narrower hook, being really the center section of the hook shown in Fig. 1. The small hook can be used on a belt half an inch in width and several of them can be used for wider belts. Fig. 4 shows end view of single section hook and illustrates clearly the cant of the teeth.

These hooks are particularly valuable in belts running at high speed and do not make the rigid joint made by wire hooks, and as they do not require to have holes punched in the belts for their insertion, they do not weaken the belt, as is done by many other fasteners now in use.

How Baltimore Banished Tramps and Helped the Idle.

E. L. Gould, writing in the *Forum*, says: Baltimore has always been a city more or less favored by that modern knight-errant, the tramp. Its climate is not too severe, and its people have for a century enjoyed the reputation of being more than ordinarily hospitable. Certain charitable eccentricities—such as soup-houses, night shelters, and depots for the free distribution of articles of subsistence, in which kind-hearted but unreflecting people indulged during the last two or three years—added greatly to its popularity as a winter resort. A Central Relief Committee [was organized last December] typifying the co-operation of business interests with philanthropy. The manifesto on winter relief which followed the organization of the Central Relief Committee set forth succinctly a programme of action.

1. Citizens were urged to contribute liberally to established charitable agencies.

2. Donations were asked to a special fund for opening a new institution to shelter the homeless, where the work test would be rigidly applied. A "Friendly Inn," capable of accommodating 150 persons nightly, was already in existence, but its housing facilities were not thought to be sufficient. Its managing board expressed the willingness to co-operate in securing a uniform work test by abolishing the system of paid meals and lodgings. The extension of facilities would enable all demands to be met, and the people were promised a diminution in the number of vagrants and tramps.

3. It was conditionally stated that, if the city would buy the stone for macadamizing roads in the annex, the Central Relief Committee would open stoneyards in order to provide work for unemployed residents with families to support.

4. A salutary warning was issued against the dangers of indiscriminate almsgiving.

Soon after the appearance of these "standards," subscriptions began to flow in, and it was decided to proceed at once with the equipment of a "Wayfarers' Lodge," to accommodate 125 persons nightly, and its rules provided for a three days' limit to consecutive shelter, unless under special circumstances. Wood sawing and splitting was offered as the only means of payment for meals and lodgings. Certain compulsory features, such as a hot bath every evening under the supervision of an attendant, with a liberal use of carbolic soap, and nightly disinfection of wearing apparel, were regularly exacted. Clean night gowns and slippers were also furnished. The Wayfarers' Lodge was opened on January 15, 1894. On the first day of January of the present year, 320 males lodged in the police stations. By January 28 there had been a decrease to 80, and on February 3 the police stations were finally closed to male lodgers. Notwithstanding this fact, there have always been unoccupied beds in the Inn and the Lodge. The record of lodgings at the Wayfarers' Lodge from January 15 to April 1 shows that the nightly average was 61. At the Friendly Inn the average for this period was 98. As a rule, the men performed the tasks they were set to accomplish. Returns from the six weeks' operation of the Wayfarers' Lodge show that less than four per cent have been ejected for refusal to work, disorderly conduct, profanity or pilfering. Of the patrons during the first twenty days of February, 59 per cent were of American nationality, 17 per cent were Irish, 9 per cent Germans, 6½ per cent English and 3¼ per cent Scotch. The nativity of the remainder included 17 foreign countries. In the matter of age, 9¼ per cent were under 21 years of age; 45¼ per cent between 20 and 30; 28 per cent between 30 and 40. More than eight-tenths of the whole number were in the flower of youth or manhood. As regards occupations, 40¾ per cent professed skilled trades; 6 per cent were lumbermen, miners and sailors; 2¼ per cent were bookkeepers, clerks, telegraph operators, bartenders and waiters; 2 per cent were farmers, gardeners, drivers, or teamsters; and 47 per cent classed themselves as general laborers.

Comparison of the statistics of lodgings in the police stations before and after the inauguration of sound practice in dealing with the homeless poor reveals a fact of weighty significance. It shows that such methods, with the hearty backing of the police, are a sure and effective means of ridding a community in an unusual degree of tramps and vagrants. The district agencies of the Charity Organization Society, which in previous winters have been besieged for help unanimously report that the demand from this class of people has been reduced to practically nothing. The number of requests for transportation from the city was notably diminished. Finally, almost without exception, citizens testify that street begging and personal importunities at their homes have marvelously fallen off. The police assert that the class of people referred to are now scarce among Baltimore's floating population.

Dealing with the homeless poor represents simply one side of the activities of the Central Relief Committee. Furnishing work to unemployed residents is the other. [Four] stoneyards were opened. The piece system of payment was inaugurated. Fifty cents was the price fixed for a unit of work which could be accomplished by a man of ordinary strength in about four hours. The maximum sum which any man might receive was $1 a day. Work was so distributed that, as far as possible, each candidate was given two days weekly, and the more necessitous three and even four. Summarizing the results accomplished in connection with the relief of unemployed residents with families to support, we find:

1. That industrial work was provided on economic principles. The actual cost was about 33 per cent of the funds raised.

2. Market rates were observed both in the purchase of raw materials and the sale of broken stone, so that no violence was done to economic laws.

3. There could be no "sojering." Inattention and neglect were at the expense of the worker, not to the detriment of the work provider.

4. Complete harmony and co-operation existed with established charitable agencies, and the latter were able to test chronic subjects for relief by securing their admission to the stoneyards.

GREAT OFFICE BUILDINGS OF NEW YORK.

A few weeks ago we had occasion to speak of the work of engineers as employed in the construction of the new office buildings, of which so many are being erected in the lower part of this city. In our present issue we illustrate a view of Broadway looking to the north from a window in the Post Office building, corner of Park Place and Broadway. Many of the street features are old. To the right is seen the Stewart building, in its day a triumph of city architecture, and on the same side, nearer the spectator, is the end of the new County Court House. But what our illustration is designed principally to show are the new office buildings built in this part of Broadway, and seen on the left side of the cut, or west side of the street.

Nearest to the spectator is the great building of the Postal Telegraph Company, G. E. Harding & Gooch, architects. This building is fourteen stories high, with a front over 70 feet wide in Broadway, and extending 156 feet down Murray Street. The walls to the fifth story are of Indiana limestone; above that gray brick, with terra cotta trimmings to correspond, is used to complete the structure. Next to it stands the beautiful 16 storied marble structure of the Home Life Insurance Company, Le Brun & Son, architects. This building is remarkable for its ornate architecture, combined, in the main, with great chasteness and purity of style, and forms a fitting companion to the more somber building adjoining it.

Following up Broadway, and passing, as we do so, the iron front building at the corner of Warren Street formerly the headquarters of the SCIENTIFIC AMERICAN, we see a tall, tower-like structure with pinnacles on its roof, rising at the corner of Broadway and Chambers Street. This curious building, adapted to meet the exigences of the restricted lot, is occupied by the Shoe and Leather Bank, and is due to Messrs. Cadey, Berg & See, architects. Again going to the north, on the corner of Broadway and Duane Street is the building of the Mutual Reserve Insurance Company, Mr. W. H. Hume, architect. Again we have a very high building in which the architect has been exceedingly successful in preserving purity of style in spite of the difficulties of doing so in a building of such exaggerated proportions. But what these buildings are on the outside does not disclose their principles of construction. They are not stone or marble buildings in the true sense of the word, but are erected on the steel girder principle. Each in effect is a frame of steel girders, self-sustaining, with steel floors and filled in or lined with stone or brick. Were the attempt made to construct the building out of stone and brick alone, the foundations and walls would be of prohibitive thickness, so that the building at the base would be but little more than a solid mass of material.

Striking as is the view we present, it is but an earnest of what is to come. The high price of real estate, in view of the solidity and safety of the investments such buildings represent, make it a matter of certainty that in a very few years one after the other of the older down-town buildings, deemed first-class in their day, must be torn down and replaced by more modern and gigantic structures. Equipped with a full elevator plant, some elevators running on the express plan, not stopping until the eighth or tenth story is reached, the upper stories are as valuable, or more so, for offices than the lower ones. The capitalization invested in the attainment of height is just as advantageous as that represented by the lower stories alone.

GREAT OFFICE BUILDINGS OF NEW YORK—VIEW UP BROADWAY FROM THE POST OFFICE.

Electrical Notes Concerning the New Postal Telegraph Building.

The new building of the Postal Telegraph Company, corner of Murray Street and Broadway, was opened for public inspection on June 18, and in its electrical equipment is probably the most complete of any telegraph building in the world. The ground floor is elaborately yet tastefully fitted up as the receiving and delivery office for telegrams. The walls and staircases are finished in beautifully colored marbles. Access to the various floors is had by swift, smooth-running electric elevators.

The top floor is occupied as an operating room, where numerous mahogany tables, supplied with the latest and most approved sounders, relays and transmitting keys, are to be seen. At intervals in the tables are placed typewriters. The sounders are supported on a brass rod about twelve inches long above the surface of the table, and are inclosed in a half dome-shaped wood box open on one side, about 8 by 6 inches. The box re-enforces the sound so strongly that it is easily heard distinctly above the other multitude of confusing sounds, and being in a line with the ear of the operator, he is able to receive the message in an upright sitting posture.

The operator, who is also a typewriter, simply sits back comfortably in his chair and typewrites the messages as fast as he receives them from the sounder. The caution published by the superintendent in regard to writers of messages emphasized the letters *t* and *k*. The small *t's* must be each separately crossed, and the *k's* made not to look like an *h*, but be clearly defined, as in the word "knock." By arranging the sounders in an elevated position all cross divisions on the desks, which usually accumulate dust, are eliminated, and a more open and airy effect is given to the entire room. In one corner of the operating room is an elevated platform where the distributing department is located, which is connected with the ground floor by pneumatic tubes, and also by tubes to each set of or section of tables. Messages to be telegraphed, we will say, for example, to Washington, are sent by this department through the tube leading to the desk to which the Washington wires come in, and the operator promptly transmits the same.

When the operator receives and prints a message, he places it in the little box and sends it by air pressure through the tube to the distributing department; thence it is sent to the basement and passed over to the messenger boys for delivery. In the story next below the operating floor are the executive offices of the company and of the Commercial Cable Company, all of which are sumptuously fitted up. A most interesting part of the building is the basement, where is generated the electrical energy which keeps this great system of telegraphy at work. In the center of the basement is a large elaborate marble switchboard, through which the main current from two of the three large Westinghouse dynamos passes. There is one switch pivoted here so arranged that in case all the dynamos should be stopped, the current from the Edison Electric Com-

pany from the street can be immediately switched in without interrupting in the least the supply of electricity. The current from the dynamos operates several combined motors and dynamos arranged in multiple series or in pairs as desired, for supplying the telegraph wires at an average pressure of fifty volts. Switching devices are arranged in connection with them for shifting the current from one to another without affecting it up stairs.

In one corner of the basement is the electric elevator driving mechanism, designed by Pratt & Sprague. It works very effectively and positively. There is a horizontal screw 25 feet long by eight inches in diameter, which has a motor attached at one end. On the screw works a huge nut attached to which on one shaft are half a dozen loose pulleys, over which the elevator propelling rope passes. By means of a special small pilot motor the main switch is operated, which turns on the current to the propelling motor in amount to correspond with the load to be carried, which is regulated by the man in the elevator. When the elevator motor revolves the screw rapidly, the nut holding the pulleys is carried forward and the elevator rises in a steady, smooth motion. To descend the current is reversed, and the screw revolving in the opposite direction draws the nut supporting the wheels back to the other end. In each case the motion is perfectly steady and positive. The elevators have been tested up to carrying two tons weight and worked perfectly.

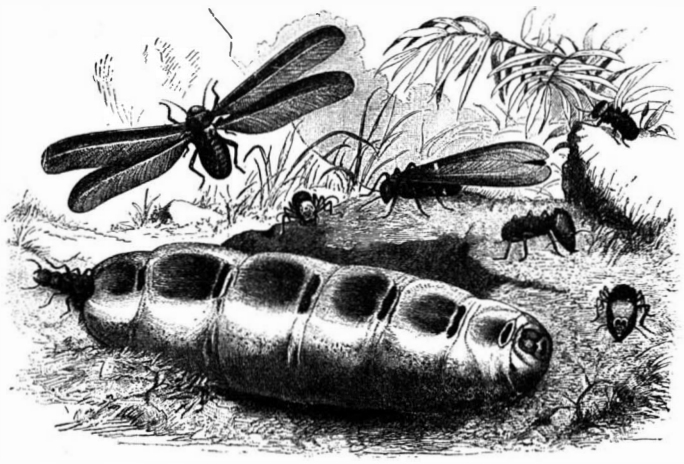
Mr. Francis W. Jones, the electrician, is credited with having arranged the electrical devices and the distribution of the electrical power in this building. His aim has been to have all of it fixed in as positive and simple a manner as possible and to provide for all kinds of contingencies. To electricians and others interested in electricity a visit to the building will be instructive.

A Few Kinks in Brazing.

Brazing is getting to be quite an art now that bicycle mending is coming in from all directions, and the way some of these thin steel tubes for the framework are handled down by the furnace-room door of an establishment is enough to make one think that soft coal and water gas must be selling cheap. A pound of spelter is first sent for, or something that will melt a trifle below the fusing point of common brass, and, if it is not already granulated, must be worked into fine powder with a file. A supply of borax is the next thing to look out for. Then if there is a gas jet handy an artificial blast can be sent through a burner of the Bunsen type and quite a heat directed on a bed of charcoal, where the delicate work is supposed to be buried waiting for the brazing. The joint to be brazed is intended to be made as firm as possible by having a close fit well pressed together, so much so that it will stand the sharpest raps of the poker, for when the brazing materials first melt and are well absorbed in the joint, it is a relief to realize what a rap will do toward working the solder through the joint and knocking off the waste material. The borax is first spread over the joint as the work is approaching a low red heat, and it soon swells up and turns into a snow-like froth, on account of the water of crystallization boiling out of it, settles down and flows over the joint like glass, ready to clean off the surface and prepare the way for the soft brass that is about ready to melt under this temperature. Then comes the green blaze that is always a sure index that the work of sweating the joint with brass is being performed. The zinc, from which is due the green blaze when the brass flashes, is employed in the brazing material to reduce the melting point of brass, and, when it volatilizes and gives off the fumes that produce the colored blazes, leaves the brass behind in a less fusible state. It stands the brazer in hand, then, to prepare the work with the brass all in position and heated so carefully that none of it will melt till the joint is well heated all alike and every portion settles down at the same moment. Borax is a substance that is supposed to dissolve all the rust and every kind of earthy substances and make a clean surface no matter how the work is brought together, but the surfaces that are found on both the outside and inside of steel pipes, as well as drop forgings, will need to be cleaned off by some other treatment in which a file or scraper will be found useful. With sheet iron a joint can be brazed by using filings from soft cast iron in the same way as if it was brass, and a joint produced that will pass off for welding. In all kinds of brazing the substance used for this purpose is inclined to etch the edges of the work and mar the surfaces wherever they have been exposed to the fused material, with the exception of silver. When used for a solder this substance has such a liking for iron and steel that it will take hold without any of that biting action whatever, and when we come to see how economically it can be used for these purposes, it would seem to be the cheaper material in the end.—*Boston Journal of Commerce.*

Action of the Liver After Death.

When a person dies, the tissues of which he is composed do not die immediately and simultaneously; so the chemical functions of the tissues continue for some time after death. The most celebrated example of the persistence of the life of the organs has been given by Claude Bernard, who has shown that the liver continues to form sugar after it has been removed from the body. Mr. Charles Richet has just proved that one of the most important functions of the liver, that of the formation of urea, continues to act the same way in the liver removed from the body and washed.



THE QUEEN ANT, SOLDIERS, AND WORKERS.

If, in fact, the quantity of urea that the liver contains be ascertained through analysis, it will be found to be nearly 0·25 per kilogramme of liver; but, if such liver extracted from the body be put into a stove at 40°, we shall find at the end of a few hours that the proportion of urea has greatly increased, and that there is then 0·9 of it. Consequently, the essential chemical phenomena continues to take place in this organ, and the glycopoictic, like the ureopoictic function, is still exerted in the liver separated from the circulation and hæmatosis.

The parallelism between these two great functions is complete. The sugar is formed through a phenomenon of diastasis, and the urea also is formed by an analogous chemical action. The demonstration of this is now made, for Mr. Richet has been able to filter the liquid expressed from the brayed liver and to establish the fact (in taking precautions, of course, against any microbian infection) that urea is produced in such liquid.

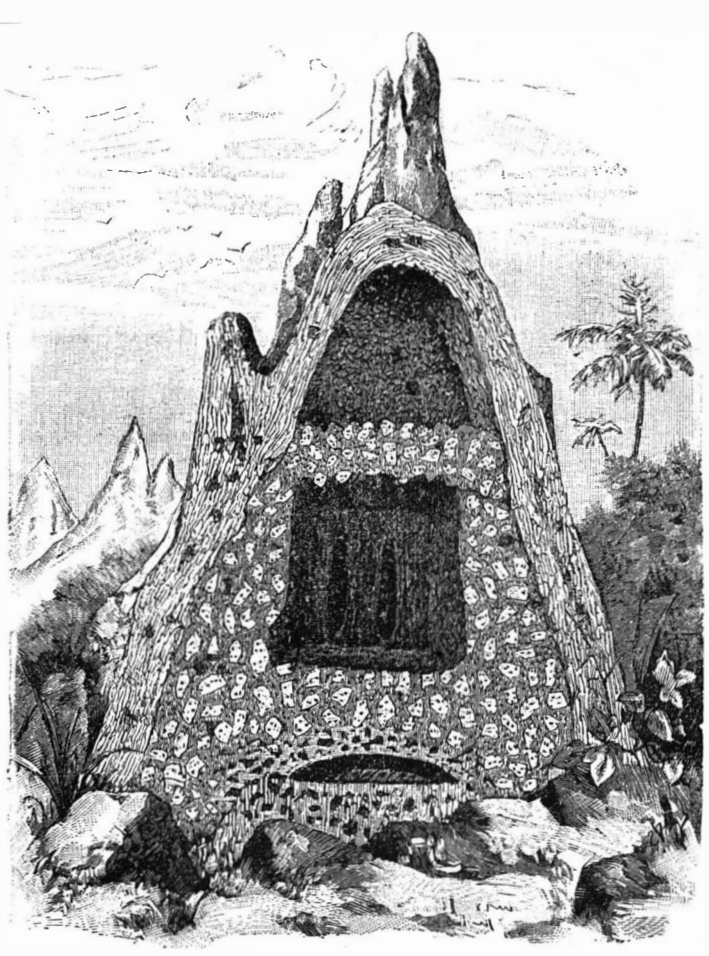
We have here the first example of a ureopoictic diastasis, and this remarkable phenomenon throws a light upon one of the functions that, up to the present, has been the obscurest of the hepatic gland.—*Le Genie Civil.*

THE TERMITES OR WHITE ANTS OF AFRICA.

The scientific traveler, Max Buchner, tells us how we may picture to ourselves the savannas of Central Africa: "First sprinkle a few million brick-red, irregular pyramids of the termite or white ant over a brick-red surface, in the proportion of, at least, five to the hectare. Next, take about four times this number of trees, and distribute them so that there shall be twenty, more or less, to the hectare. Then distribute, in like proportion, an equal number of Bushmen. Finally, fill up the intervening spaces with clumps of high grass, just far enough apart to render visible the red earth between. Do this, and you will have a faithful representation of the open African forest, but little influenced by the destructive hand of man."

The presence of these white ant pyramids is the characteristic feature of the African landscape. The builders of these structures are not ants; but belong to the much smaller family of termites. There is scarcely an insect so thoroughly hated by man as the termite, and the hatred is fully justified. "There are regions in Africa," writes a traveler, "of which it is safe to say that if a man with a wooden leg were to lie down to sleep at night, nothing of the leg would be visible in the morning save a little sawdust." The termites gnaw away everything; the balconies and posts of the houses, tables, chairs, wardrobes, books, leather, cloth—in fact, little comes amiss to them except iron—though, strange to say, on the authority of Franz Leuschner, they will not touch the European pine and fir timber brought to Africa for building purposes. The evidences of the destructive labors of the termites are to be seen on every side; but the creatures themselves are rarely seen. They steal sneakingly to their labors. They are all blind, with the exception of the king and queen, and all defenseless except the soldier caste, which constitutes about one or two per cent of the population. To escape starvation they must leave their subterranean homes or pyramids in search of dead wood, and, because of their blindness, they render themselves invisible as the best mode of defense.

If one has an opportunity to observe the insect in his work of destruction, the sight is really a most remarkable one. Here is an opening in the earth. A little head appears in it, with a pellet of clay in the jaws; the pellet is laid down, and soon another head appears with another pellet covered with a viscid salivary secretion, by means of which the pellets are fastened together. In this manner, by incessant toil, a small clay tube is constructed, and prolonged until it strikes against a piece of dead timber, the soldier termites guarding the opening from hostile insects the while. The termites then gnaw their way into the timber, eating or removing the whole inner contents, leaving only a thin outer shell. These tubular passages, made by the termites, are even more wonderful than their pyramids. They are about the diameter of a small gas pipe, and are frequently carried in a zigzag course by the termites up the trunk of a tree in their search for a dry branch. One may travel for hours and not find a single tree without one of these passages.



PYRAMIDS OF THE WHITE ANTS.

In spite of their destructive proclivities, the termites perform much useful work. There is a certain neatness in the open park-like scenery of Central Africa which strikes one immediately. It gives one the impression that it is scrupulously swept and cared for, and one asks himself, involuntarily, what good fairy maintains such perfect neatness and order in the wilds? There are, indeed, forest keepers of various species, who are continually occupied in the removal of all dead animal matter, from the fallen elephant to the dead fly, and who bury in the purifying earth what they cannot consume. What these do for animal remains, the termite does for the vegetable kingdom. Every trunk, branch, twig, or old bark layer the moment it is smitten with death, is attacked by the white ants who subsist on it, and whose numbers are limited only by their means of subsistence. The balance between them and the vegetable kingdom is thus maintained by natural law. If we examine their pyramids, we find that the interior, as shown in the illustration, contains innumerable chambers connected by passages. There are store rooms, breeding rooms, and nurseries. The chamber of the queen is near the ground, and frequently below the surface. Each of these settlements may be taken as representing a kingdom whose people are divided into distinctive castes, with division of labor. First, there are those engaged in the perpetuation of the species. There is only one queen in each settlement, and she, when fertilized, is enlarged to a cylindrical shaped figure, several centimeters long, with nothing in her appearance, except her head, to

suggest what she is. She is carefully watched and tended and fed by her subjects, and lays eggs upon eggs, many thousands a day, and that for months continuously. The other castes, shown in the illustration, are the soldiers, recognizable by their massive heads, and the workers, with the little round heads. The later provide the food and nurse the young, and know how to feed the nymphs, so that they can develop a worker into a queen if there is occasion for one, that is, if the reigning queen should die.

The great work of the white ants, analogous to the labor of worms in temperate climates, is to bring up the subsoil clay to the surface, where it sooner or later mingles with the surface soil, and perhaps gets washed away to form new valleys. One must study the works of these little creatures carefully to form an idea of their extent and importance.—*Die Gartenlaube, Leipzig, No. 9; Translated and condensed for the Literary Digest by C. Falkenhorst.*

Electric Notes.

The growth of the electrical engineering profession in this country is marked by the fact that the American Institute of Electrical Engineers has just celebrated the completion of its first decade. The society is one of the youngest of the engineering bodies, but is characterized by great activity and steady growth. It has begun the present year more than 800 strong, and has attained an annual increase in membership of about 150. One of the most interesting features of its recent work has been the attempt to deal with a question that has had very serious consideration from engineering and other societies in America, namely, how to give all the members as far as possible an equal share in the benefits of frequent meetings. In some of the professions, that which should be a vigorous national organization is represented by local or sectional societies, and much of the good that would come from the action of one representative body, on important matters, is lost. The electrical engineers have tried the plan of having simultaneous monthly meetings in more than one city or center, at which exactly the same paper is presented for discussion. New York and Chicago have adopted this method, and so far it has worked with such success that other cities are falling into line. By this plan all general important questions are left for settlement at the general meeting attended by all members in common.

Prof. W. A. Anthony, formerly of Cornell University, has been making forcible objection to some of the methods in vogue for the subdivision and distribu- [illegible] He is decidedly in favor of the small unit or incandescent lamp, as compared with the large unit or arc, whether we consider the illumination of a large space or ordinary street linear lighting. Remembering that nine 16-candle power incandescent lamps can be run with the power required for one 405 watt arc lamp, the arcs must be nine times as far apart as the incandescent consuming the same power, and to give the same illumination must be eighty-one times as intense, or about 1,300 candle power. But in no arc lamp as used for street lighting do the rays proceeding toward the more distant points to be illuminated reach more than a quarter of such intensity. Prof. Anthony expresses his opinion that the location of the arc lamps at intervals of 1,000 to 1,600 feet, as they are often seen in pretentious villages or suburban towns, is an entire waste of money. Incandescent lamps at intervals of 100 to 200 feet, run by the same power, would give a far better illumination. It is curious to note that frequent attempts have been made at street lighting by incandescents, but uniformly without great success; and that meanwhile it is a rapidly spreading practice to use the Edison mains, ordinarily employed for interior lighting, for the further service of arc lights on the streets. New York, Brooklyn, Boston, and other cities have to-day thousands of arc lights burning in this way at low and perfectly safe potentials.

Of the five or six hundred electric roads in this country a large proportion reach natural or artificial waters, such as lakes or rivers, and in all parts of the country a large amount of work is now being done in the utilization of the current from the trolley wires for charging storage battery boats to ply on these waters. The success of the World's Fair electric fleet, which carried without an accident 1,000,000 passengers on the lagoons and canals in Jackson Park, directed attention to the subject, and now the fleet is being dispersed to all points of the compass for kindred employment. Milwaukee, Boston, Rochester and other cities are to have large fleets, and in many places the work has actually begun, with remarkable results. It is pointed out that a street railway which will carry a passenger for an hour for five cents can easily earn from him five times as much for half an hour's trip on the water, with less expense. At Altoona, where an artificial lake of thirteen acres has been made, ten cents is paid by hundreds of delighted passengers for a trip around lasting only seven minutes. Electrical boats are also being built now for regular ferriage, and a line is projected to ply between the smaller ports on the Gulf of Mexico. Some of the newer boats are of ample proportions, Mr. John Jacob Astor being the owner of one forty-six feet long.

The vast engineering enterprise now being carried out for the utilization of a part of the energy of Niagara has stimulated attention to the subject of water powers all over the country. Many of them are being quietly bought up, and others are very freely discussed, while on a third class heavy expenditures are already being made. One of the most ambitious of these projects is that for which a big dam has been thrown across the Colorado River, near Austin, Texas, by municipal funds, and which only depends for its completion on the raising of the full $1,500,000 voted by the citizens. This dam is of solid granite and limestone masonry, 1,150 feet long, 66 feet wide at the base, 18 feet wide at the top, and 6 feet high above low water. By its means the river at this point has been turned into a lake 30 miles long, in places 2 miles wide. It is estimated that 100,000 horse power can be furnished when the plant is ready, and one mildly wonders what Austin, a city of but 25,000 people, is going to do with so much, unless it should attract manufacturing industries from all over the South by its cheap power.

The lapse of the Edison incandescent lamp patents in Europe has had the effect of bringing so many new, cheap, and bad lamps on the market that all the manufacturers there are agitated. These patents and those on the telephone have been the only electrical ones that have been sustained by the courts, and now that they have run out, the temptation to enter the field appears to have overcome common prudence. Hence incandescent lamps have sold in London at 14 cents apiece. The lowest price in New York is at least twice as much, and is admitted by experts to be fair. A union is now being formed at Berlin to which all the leading lamp manufacturers of Europe have given their adhesion, which will probably prevent further cutting. The price is likely to be about that which now prevails in America. The complaint is made that fixing the price is a small matter compared with fixing the voltage. Instead of a few standard voltages being in existence, there are literally scores, all of which complicate matters, it is said, and add greatly to the cost of production. The point is made that in Europe, or at least in England, the unit of illumination for a lamp is 10 candle power, whereas in America the unit is 16 candle power, another instance, it is alleged, of American extravagance and absence of economy.—*The Evening Post, N. Y.*

How to Can and Preserve Fruit.

Before preparing fruit for canning, the glass jars, new and old, should be thoroughly washed and partly filled with warm water, sealed, and turned upside down on the table, to determine that they do not leak. Fruit often spoils because care is not taken in selecting perfect jars and rubbers. To prevent cracking, the jars should be thoroughly heated before pouring in the boiling fruit; this can be accomplished by having all the jars to be filled standing in a pan of hot water, and just before using each jar, filling it with very hot water for a few seconds. Pour out the water and stand the jar on a plate to fill. The fruit should always be boiling hot when canned; if it should cool before poured in the cans, it must be placed on the stove and reheated before proceeding. In canning all kinds of fruit, overflow the jars before sealing.

Strawberries Canned.—Hull, weigh, and wash. Allow half a pound of granulated sugar to one pound of strawberries. Use no water; enough adheres to the berries to keep the sugar from burning. Put the sugar and strawberries into the kettle in alternate layers, and gradually heat through on back part of stove. Bring forward and boil five minutes. Have the jars thoroughly heated, fill to overflowing, and seal as quickly as possible.

Preserved.—Allow one pound of granulated sugar to one pound of strawberries. Place together in a kettle on back part of stove until the sugar is dissolved into sirup; then bring forward and boil slowly until sirup thickens when cooled; test it, after cooking about forty or fifty minutes, by cooling a little in a cup. Put into heated jars, but do not seal until the preserve is cold.

Pineapples Canned.—Slice, peel, and cut into small pieces. Allow three-quarters of a pound of granulated sugar and one pint of water to two pounds of pineapple. Boil together about ten minutes, put into heated jars, fill to overflowing, and seal as quickly as possible. Pineapples weighing about four pounds make about two pounds of fruit when peeled.

Cherries Canned.—Allow three-quarters of a pound of granulated sugar and a half pint of water to two pounds of cherries. Gradually heat together, and boil slowly for ten minutes. Have the jars thoroughly heated, fill to overflowing, and seal as quickly as possible.

Preserved.—Allow one pound of granulated sugar to one pound of cherries. Place together in a kettle on back part of stove, until the sugar is dissolved into sirup; then bring forward and boil slowly until sirup thickens when cooled. Test it, after cooking about forty or fifty minutes, by cooling a little in a cup. Put into heated jars, but do not seal until the preserve is cold. For preserving use tart cherries, pitted. —*The Outlook.*

Legal Decisions.*

IMPLIED POWERS OF CORPORATIONS.

The doctrine that a corporation has, by implication of law, and without any express grant of power in its charter or governing statute, the power to do whatever is reasonably necessary to effectuate the powers expressly granted it, and that a large discretion will be allowed to it in the choice of means, has received an apt illustration in a recent decision of the Supreme Court of the United States (Fort Worth City Co. *vs.* Smith Bridge Co., 151 U. S., 294), where it was held that a corporation created for the purpose of dealing in lands and expressly empowered to erect bridges, subdivide and sell the same, and to make any contract essential to the transaction of its business, has the implied power to make a contract for the construction of a bridge to render its lands accessible, and that it may agree to pay therefor in its bonds, and in the bonds of another corporation controlled by the same party.

PAYMENT.

The Court of Appeals of the State of New York in Goshen Nat. Bank *vs.* The State (36 N. E. Rep., 316) recently passed upon a case in which the cashier of a national bank was also a tax collector, and in his character of tax collector was indebted to the State. To pay this debt he drew a draft on the bank of which he was cashier, without funds there, and the draft was paid. The bank brought an action against the State to compel the refunding of the money. It was held that the action would not lie, if the officers of the State receiving the money had no knowledge of the fraudulent character of the draft.

HOMICIDE BY ESCAPING FELON.

In Tolbert *vs.* the State (14 South Rep., 462), the Supreme Court of Mississippi holds that where a penitentiary convict escapes and is pursued and turns and kills one of his pursuers, this is murder, although the convict did not fire the first shot. The court said that an escaped convict arrays himself against organized society. It may be added that his purpose in arming himself with a loaded weapon is obviously to kill any one lawfully attempting his rearrest, in case it may be necessary for the escaping man to do so in order to secure his liberty. The malice prepense is all there. The occasion for firing the fatal shot is created by the unlawful act of the felon, and not by the lawful act of the pursuer. In such a case the pursuer is entitled to use his weapon upon slight indication of an attempt on the part of the felon to use his.

HEAPING INSULT UPON INJURY.

At the last term of the Wake County (N. C.) Superior Court, at Raleigh, the following facts appeared: A little half-grown bull was on the railway track. He answered the whistle of an approaching train with a bellow of defiance and a toss of gravel over his shoulder. A tramp who happened to be close behind him stepped off the track and waited to see the fun. The engine struck the little bull fair, doubled him up like a ball, and sent him twenty-five feet as if shot from a catapult. The bull-ball made a line shot and knocked the tramp into a little pond near the road. When the engineer backed the train to take stock of the damage done, the tramp was crawling up on a log out of his involuntary bath. Under advice of counsel learned in the law, action was brought against the railway corporation for the personal injuries and indignity inflicted. On the trial, to the surprise and intense disgust of the plaintiff, the verdict went against him. To a sympathizing bystander he placidly remarked that he had been "bowled over into a goose pond by a little doity piney-woods bull, and that a dozen jackasses had kicked him out of the court house."

THE MICHIGAN "JAG-CURE ACT."

The legislature of Michigan recently enacted a curious statute known as the "Jag-Cure Act." It allows a justice, upon the conviction of a disorderly person, instead of requiring a recognizance for good behavior, to accept a recognizance conditioned that the defendant will take the cure for the liquor habit in conformity with the rules and regulations of some corporation administering the cure. The Supreme Court of Michigan has held the act unconstitutional, on the ground that it remits the nature and extent of the punishment to the determination of the fluctuating rules of a private corporation, and transfers, in a measure, the pardoning power of the governor to such body.

HUSBAND AND WIFE.

Deed from wife to husband, delivered after the passage of the act permitting such conveyance, is valid, though the contract therefor was made, and the deed was otherwise executed, prior to the act. Reynolds *vs.* City National Bank, 24 N. Y. Supp., 1,154.

* From the *Literary Digest*, a weekly compendium of the topics of the day, published by the Funk & Wagnalls Company, New York.

Some Foreign Guns Described.

According to the *Army and Navy Journal*, the Albini rifle has a caliber of 11 millimeters, and its projectile weighs 25 grammes, and has an initial velocity of 417 meters. The improved Mauser has a caliber of 7·65 millimeters, the weight of the bullet is 14 grammes, its length 30 millimeters, and the outer covering is of maillechort metal; its initial velocity is to be determined with the adoption of another kind of powder. The Chassepot and the Gras have each a caliber of 11 millimeters, and are charged with smokeless powder; the Lebel (these three are of French invention) has a caliber of 8 millimeters, a bullet weighing 15 grammes, and 28 millimeters in length; it is incased in maillechort metal (an alloy of copper, nickel, and zinc), and its initial velocity is of 570 meters. This latter gun was improved in 1891 by the Berthier rifle, whose caliber is 0·301 inch, the bullet weighs 205 grains, and is projected by 33 grains of smokeless powder, instead of 46 grains in the Lebel. The magazine contains four charged cartridges, and the Lebel eight; the gun itself also is lighter, 8 pounds 5 ounces. The Martini-Henry rifle bullet is made of 1 part of tin and 12 parts lead; it is cylindro-conoidal, solid, compressed, length 1·27 inch, and has a slight cavity at the base, which is 0·450 inch in diameter; its present weight is 410 grains (formerly 480), and its charge of powder 80 grains. There is a paper cap over the bullet, lightly smeared with beeswax. Its rapidity of fire without aim is 25 shots in a minute.

The Schmidt rifle, model 1889, is the one adopted in the army of Switzerland, and resembles the Wetterli, until very recently used by the Italian troops. Its caliber is 0·295 inch, it weighs 10 pounds 4 ounces, the magazine contains twelve cartridges, the bullet has an outer covering of steel, its muzzle velocity is 1,920 feet in a second, its range 2,100 yards, and the weight of 150 charged cartridges 8 pounds 4 ounces. The Russian army is provided with the Mouzin and the Berdan rifles, both of the same caliber, 0·300 inch, weight 9 pounds 5 ounces, with five charged cartridges in the magazine. Its steel-covered bullet has an initial velocity of 2,000 feet, sighted to 2,100 yards, and the weight of 150 charged cartridges is 7 pounds 7 ounces. These two guns have lately been improved upon by Dandeteau, by reducing the caliber to 6·5 millimeters. The cartridge is charged with 2 grammes of smokeless powder, the bullet having an envelope of maillechort metal. The whole, ready to fire, weighs 21 grammes. At a distance of 25 meters from the mouth of this new weapon the velocity of the projectile is 715 meters per second. The present rifle of the Italian soldier is the Carcano, 1892, which has a caliber of 0·256 inch (the smallest), and weighs 8 pounds 5 ounces. It is a steel-covered bullet, weight 170 grains, projected by 34 grains of powder, having an initial velocity of 2,320 feet per second (the greatest) and a range of 2,100 yards. The magazine contains five cartridges, and the weight of 150 of them, ready for use, is 7 pounds 1 ounce (the lightest).

The Spanish army is now being provided with a modified Mauser rifle, whose caliber is 0·295 inch, cut-off type, central magazine, having five ready cartridges in it. Portugal adopted the Kropatschek rifle, which has a tubular magazine, caliber of 0·315 inch. The gun weighs 10 pounds 2 ounces. The bullet weighs 245 grains, and is projected by 70 grains of black powder. It has an initial velocity of 1,760 feet per second, and the magazine carries eight ready cartridges.

The Lee-Metford rifle has superseded the Martini-Henry as the fighting gun of the British troops. Its caliber is 0·303 inch; it weighs 9 pounds 4 ounces, the bullet has a cupro-nickel envelope, weighs 214 grains, and is discharged by 66 grains of black powder, has a muzzle velocity of 1,830 feet per second, its range 2,100 yards. The magazine contains ten ready cartridges (the largest number but one of all the modern small caliber rifles), and the weight of 150 charged cartridges is exactly equal to the weight of the gun itself.

THE tax of 10 francs a year on cycles, which was imposed in France last April, yielded in the first half year, it is said, over 780,000 franc

THE IRRIGATION OF LAWNS.

Among the surroundings of a country dwelling, perhaps nothing adds so much to its rural charms as a green and flourishing lawn. The eye ever rests upon it with delight; and if there are extended prospects, the lawn lends beauty to the scene.

In order to preserve a lawn in freshness during the parching days of summer the grass must be repeatedly watered; and if the lawn is of much extent, this work of irrigation is no easy job. A common method is to have a hollow standard provided at its top with a rotary perforated head. This, when connected with the supply

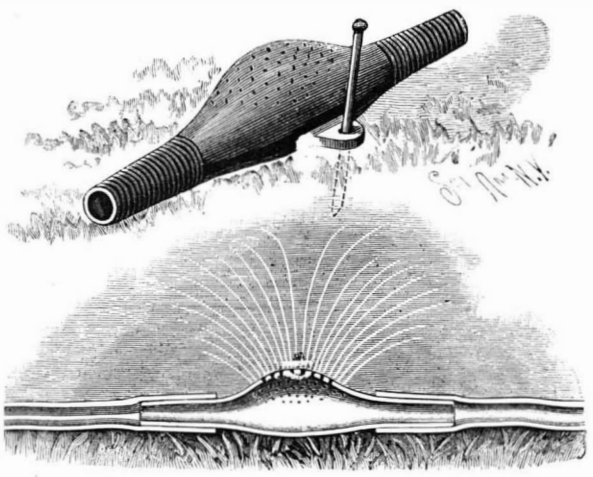


Fig. 2.—FOUNTAIN PIPE SECTION.

hose, throws a gentle rain over a considerable space; after which the standard is moved into a new position and another part of the lawn is watered, and so on. The time and attention of one or more men, according to the size of the lawn, is required for this duty.

The object of the present invention is to effect the instantaneous irrigation of every part of the lawn, at any time desired, without the interposition of a special attendant, such irrigation being effected by simply turning the water faucet, which any member of a household may do.

For this purpose the usual lawn hose is employed, which is divided into various sections, the ends of which are connected to a series of short fountain pipes, as shown in our engraving, Fig. 1. In Fig. 2 is seen an enlarged view of one of these fountain pipes. They may be made of copper for durability, but a cheaper material is tin, and it answers very well. One side of the pipe is provided with an ear, through which passes a long pin, by which the fountain pipe is fastened to the ground. The central part of the fountain pipe is enlarged, as shown, and is perforated with fine holes, so that the escaping water from the several fountain pipes will issue in the form of fine showers, as shown in Fig. 1.

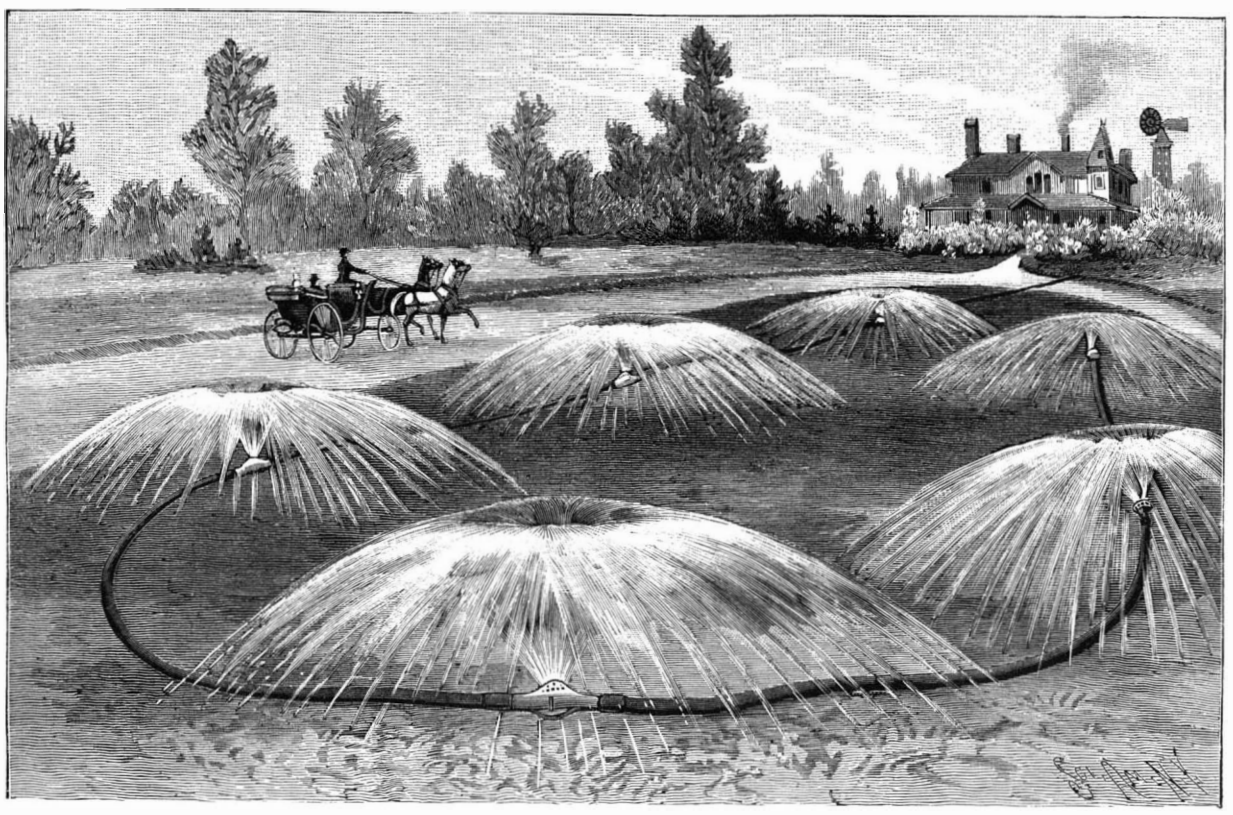


Fig. 1.—FOUNTAIN PIPES FOR LAWN IRRIGATION.

In practical use the hose, furnished with the fountain pipes, is laid throughout the lawn, and the pipe pins are driven down to hold the fountain pipes in proper position. The water valve is then opened, when the entire lawn will be thoroughly and quickly showered. The hose and fountain pipes may be left in position upon the lawn throughout the season, and the lawn may be irrigated whenever desired simply by turning the supply faucet.

Planet Notes for July and August.

H. C. WILSON.

Mercury, having been visible in the evening during the last days in June, will in July pass between us and the sun, being hidden by the rays of the latter during the greater part of the month. He will be at inferior conjunction July 20 at 4 h. 28 m. P. M. central time.

Venus is slowly receding from us and moving around behind the sun. Her disk will be 0·76 illuminated July 1 and 0·92 August 30. Venus will pass by Jupiter on the morning of July 20, the nearest approach of the two planets to each other occurring at about 2 h. 30 m. A. M. On the morning of July 28 at 6 h. 13 m. Venus will pass very close to the third magnitude star *u* Geminorum, the difference of declination of the two bodies at the time of conjunction being only 3′. August 8 at 7 h. 45 m. A. M. Venus will pass 9′ to the south of another third magnitude star, *δ* Geminorum. Venus will be in conjunction with the moon July 30 at 1 h. 34 m. A. M. and August 28 at 7 h. 23 m. P. M.

Mars will come into good position for observations after midnight by the 1st of August, and it is to be hoped that observers will begin early to study the markings on the surface of the planet. It is not necessary to have a great telescope in order to see them to good advantage. In fact, there are some good observers who believe that planetary details can be seen better with small than with large telescopes. We do not subscribe to this belief, but do say that the difference in favor of the large telescope is not so great as to entirely discourage the possessor of a good small one from attempting to add to our knowledge of the planetary markings.

Jupiter and *Neptune* are coming round as morning planets, but will not be in good position for observation during the summer. As already noted, Jupiter will be in conjunction with Venus, 51′ north of the latter, on the morning of July 20. Neptune will be still closer to Venus, only 9′ north, July 11, 11 h. 54 m. P. M.

Saturn will be visible in the early evening, but will be pretty low in the west by the time twilight is over. Saturn and the moon will be in conjunction July 9 at 9 h. 11 m. P. M. and August 6, 7 h. 30 m. A. M.

Uranus is making the turn of the loop in his apparent course among the stars and will be almost stationary during July. In August he will move eastward toward the star *a* Libræ. Uranus will be in conjunction with the moon July 11 and August 7.—*Astronomy and Astro-Physics.*

Another Inventor of the Telephone.

Those of our readers who have all along believed that Prof. Bell was the original inventor of the speaking telephone, or, perhaps, Dr. Gray, and that Blake or Berliner or Reis were the pioneers in the microphone field, will be somewhat surprised, says the *Electrical Engineer*, to learn that the honor of having made the first microphone is now claimed by Dr. R. D'Unger, of the D'Unger Long Distance Telephone Company, at Chicago.

The doctor states that as early as January 29, 1869, he filed a caveat for his "Electro-Medical Music Box," and that in 1879 a pair of small musical boxes were insulated according to the claims in the caveat and perfect speech was had from them.

The gist of the doctor's invention consists, as he explains, in the fact that by taking two ordinary Swiss musical boxes and insulating the harp plate and frame from the cylinder carrying the note pins and connecting the two instruments by means of a wire carrying an electric current, not only the musical impulses of one of the boxes will be transmitted to the other, but that articulate speech can also be sent over the wire.

Although the doctor makes the above claims and insists that he had a talking machine several years before Prof. Bell and also before Elisha Gray's harmonic telegraphs were known, he makes no claim that he is the discoverer of the art of telephony, but accords that honor to Charles Bourseul, of Paris, France, who in 1854 told in plain words how a telephone could be made and what it could and would do.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING.—Emerson L. Bolles, China, La. According to this improvement the drawhead has a vertically oval throat and a lateral chamber in which a spring-pressed latch block, hook shaped at one side, is movable transversely, a hook-ended link bar being adapted to engage the block, on which there is a shackle loop, links and levers being connected with the block to retract it. The coupling is automatically effected as the cars come together, even if the cars vary considerably in height, and the uncoupling may be conveniently accomplished from either side or the top of the cars.

FENDER FOR TRAM CARS.—Samuel J. Rosenfeld, New York City. This is a rotary fender, in which projecting shafts beneath the platform, and actuated from the car platform, rotate stout wire or sheet metal fender arms in a manner adapted to throw away from the car any object in its path. The fender shafts are preferably arranged in triangular form, constituting the sides of a pilot, the front of which consists of a vertical lattice body. The improvement may be quickly and conveniently attached to any car, and is concealed by the platform.

Mechanical.

BEAM FRAMING MACHINE.—Robert H. Ireland, New York City. This is a machine by means of which iron beams may be shaped in the shop ready for framing, so that when set up they need only to be put in place. It has a reciprocating knife head mechanism carrying knives above a table fitted to support a beam in upright and horizontal position, the table having adjustable portions to increase or decrease its beam openings. Two different knives are arranged to cut the top and bottom flanges of a beam, while a third knife cuts the web.

TIRE TIGHTENER. — William T. Mackey, Vancouver, Canada. This invention provides means for expanding wheels after they have shrunken and become loose in the tires, so that they will snugly fill the tires, and the wheels will also be held in their expanded position. It is a simple and powerful screw-actuated apparatus, which may be conveniently clamped to the spoke of a wheel and applied to its felly, to pull out the felly in relation to the spoke and separate the ends of the felly sections, spoke washers being employed and a wedge plate entered between the felly sections.

Agricultural.

THRASHING MACHINE ATTACHMENT.—Moses Schlatter, Burrton, Kansas. The band cutter and feeder which form the subject of this invention are designed to make it impossible for the cylinder of the thrasher to draw to it more material than it is designed to receive, while assuring a regular and gradual feed, the quantity fed being under the complete control of the operator. The feed rollers maintain an adjusted distance apart and have spikes or teeth so located that some of them will be at all times in engagement with the grain, whose movement to the cylinder will thereby be nicely regulated. The improvement may be readily applied to any thrasher.

AUTOMATIC HAY PRESS FEEDER.—William H. H. Johnson, La Due, Mo. This improvement consists principally of a rake for raking the hay into the plunger box feed hopper. a feed bar being pivoted on the rake and adapted to press the hay down the feed hopper into the plunger box in advance of the reciprocating plunger. The device is of strong and simple construction, and automatically and continuously feeds the hay into the plunger box of the press, in unison with the movement of the reciprocating plunger in the box.

COVER FOR BUTTER RECEPTACLES, ETC.—Henry C. Carter, East Orange, N. J. This is an improvement on a formerly patented invention of the same inventor, in which the cover had a movable central part or locking tongue, and provides for making such tongue of wedge shape, with outwardly beveled sides, to be engaged by corresponding undercut sides of the cover, so that when the cover is properly placed and the tongue driven home the cover will be firmly held down and prevented from rising or leaking in the center.

Miscellaneous.

STREET SWEEPER.—George Morrow, Salt Lake City, Utah. This machine is designed to sweep a street or road and deliver the sweepings to one or more receptacles carried by the machine and removable therefrom, the operation of the machine being automatic, and provision being made for removing from the path of the broom large stones or other obstacles. The latter are removed by an adjustable mould board, and means are provided for elevating the broom and connected parts from the ground when desired. The mould board may also be used for removing snow from the ground or as a road scraper, the broom, in the latter case, being held out of the way.

UNICYCLE.—Henry J. Sacksteder, Louisville, Ky. A wheel in which are arranged supports for the rider has in its rim friction rollers, while an exterior rim carries the tire, a traveling chain or belt being interposed between the exterior rim and the friction rollers, the belt or chain passing over a driving wheel with the usual treadles, there being also an additional set of friction rollers to hold the belt or chain to the rim of the driving wheel. The wheel is designed to be rapidly propelled with but little power.

DOOR AND HINGE.—William Vaughan, Jr., Passaic, N. J. The door frame, according to this invention, has recesses in its upper face at opposite sides of the door opening, and the hinged doors are flush with the outer face of the frame and each provided with slotted hinge butts having inclined or undercut end walls, while links pivoted in the butt slots have ends inclined to engage the undercut, the stationary slotted butts being secured to the outer walls of the frame recesses to which the outer ends of the links are pivoted. The improvement is especially applicable to a cellarway or bulkhead, closing it snugly with a practically flat exterior surface without protruding hinges, permitting the doors to be securely locked on the inside, and preventing any water running through on the floor below.

GAS GOVERNOR.—Silas H. Moore, New York City. This improvement relates to governors designed to maintain an even pressure at the burner, and particularly to that class in which a float actuated by the back gas pressure is used to regulate the movement of a controlling valve. The invention simplifies and reduces the cost of construction of the valve casing and renders it more compact, and also adapts it for attachment to and support of the liquid seal tank in a superior manner.

PHOTOGRAPH DISPLAY CABINET.—Henry W. Potteiger and William A. Kohman, Reading, Pa. This is a photograph album in the form of a cabinet or casket, arranged so that the photographs may be readily carried to a vertical position for display, while they will be compactly located in the cabinet when not being viewed. The mechanism is simple and inexpensive, and any one of the photographs in the cabinet may be brought to a position of display by simply pressing a button or operating a conveniently placed lever.

MUSICAL INSTRUMENT.—Bernhard H. Monneuse, Brooklyn, N. Y. This is a tubephone, or an instrument made up of a series of tubes, the tubes arranged in such order that when struck by a hammer the scale may be played in whatever key the tubes have been tuned to, or any piece of music written in such key. The tubes are designed to be suspended in a frame in a very simple and expensive manner, and so that it will be exceedingly simple to make the necessary repair should any tube support be broken.

TUNING DEVICE.—Daniel M. White, Boston, Mass. This is a device for tuning stringed instruments, such as pianos, etc. The outer ends of the strings, after leaving the bridge, are each connected with a lever fulcrumed at the base of the bridge on the string plate, the free end of each lever being engaged by a wrest pin screwing in the string plate and extending into openings formed in the pin block, so that any sound passing through the wrest pin also passes into the pin block and to the other wooden parts of the frame. The device is of simple construction, and designed to hold the strings more permanently at the proper tension, permitting the operator to quickly and accurately tune the instrument without much exertion.

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.

NEW BOOKS AND PUBLICATIONS.

THE PRINCIPLES OF ELLIPTIC AND HYPERBOLIC ANALYSIS. By Alexander Macfarlane. Boston, Mass.: J. S. Cushing & Co. Pp. 47.

This monograph is an abstract which was read before the Mathematical Congress at Chicago last year. The subject is such that it will not admit of review within our limits. As an example of printing it is worthy of all commendation.

ON THE DEFINITIONS OF THE TRIGONOMETRIC FUNCTIONS. By Alexander Macfarlane. Boston: Norwood Press. J. S. Cushing & Co. Pp. 49. Price 50 cents.

In this we have another paper by the same author, read before the Chicago Congress. Like the other one just reviewed, we cannot go beyond our limits in order to give an adequate notion of what it contains. The two will be found of great interest.

THE GAS ENGINEER'S LABORATORY HANDBOOK. By John Hornby, F.I.C. London, England: E. & F. N. Spon, No. 125 Strand. New York: Spon & Chamberlain, 12 Cortlandt Street. 1894. Pp. xvi, 304. Price $2.50.

In this work the gas engineer seems to receive at last the attention which has long been his due. It treats of true chemical determinations of substances which come within the scope of the gas engineer, and is not devoted to the inadequate and approximate methods which have so long been made to do duty in the text books of the past. Written from the English standpoint, we naturally find some American methods, or methods that have been proposed in America, omitted. Much of the text takes the aspect of analytical chemistry, but the modern gas engineer is often a fair chemist, and able to execute such operations as are here described.

ELEMENTARY NAVAL TACTICS. By Commander William Bainbridge-Hoff. First edition, first thousand. New York: John Wiley & Sons. 1894. Pp. viii, 110; 15 folding plates. Price $1.50.

The author of this work on naval tactics dedicates it to his son, "an officer of the United States Navy, serving in the fourth generation." The dedication adds interest to the book from the personal standpoint. It is written up to the times and describes fleet maneuvers with steam vessels—something of course radically different from the practice of old times, when sailing vessels were used. It should find extensive circulation among naval officers especially.

IN THE REDWOOD'S REALM. Compiled and arranged by J. M. Eddy, under the direction of the Humboldt, Cal., Chamber of Commerce. Printed by D. S. Stanley & Co., San Francisco, Cal.; engravings by Bolton & Strong, San Francisco, Cal. 1893. Pp. 112. Price 50 cents.

The many illustrations by half tone process of scenes in Humboldt County, California, make this book one of considerable value, although it is published only as a species of advertisement. Remarkable growths of redwood and the cutting and working of same, and scenes in the cities and settlements in the great western land, make the pamphlet of unusual interest to all.

CARD GAMES AND HOW TO PLAY THEM. Publishers' seventh edition of Rules of Popular Games. Cincinnati: The United States Printing Company. Pp. 82. Price 25 cents.

This short work, bound in paper, represents really the most advanced and latest views on poker, whist, and other games of cards. It will be, we are sure, of interest and value to those who desire to play cards in accordance with the most recent rules.

EXPORTERS' HAND BOOK ON MEXICO. Valuable information to American manufacturers desiring to cultivate Mexican trade. Compiled by Phillip G. Roeder, Cleveland, O.; Calla de La Palma, No. 2, Mexico City, Mexico. 1893. Pp. 65. Price $5.

This little volume is a list of cities and prominent firms therein in Mexico. It will be of considerable use to merchant travelers, exporters, and manufacturers.

PUBLICATIONS OF THE LICK OBSERVATORY OF THE UNIVERSITY OF CALIFORNIA. Printed by authority of the Regents of the University. Volume II. Sacramento. State Office: A. J. Johnson, Supt. State Printing. 1894. Pp. 255.

The contents of this volume, the second volume of the publications of the Lick Observatory, are largely technical. Of course the book will be a necessity to every astronomer.

COUNTRY ROADS. By Isaac B. Potter. Pp. 64. Price 10 cents a copy.

Mr. Potter, well known for a number of months as the editor of the magazine *Good Roads*, published in the interest of the highways of the United States, proposes to issue bi-monthly or every second month a little volume like the present, on some subject appertaining to good roads. The present, which is the first of the set, is addressed to the farmer and tells how the roads in the country may be improved and maintained. It is a most attractive and interesting book, and we are sure the series of which this is the first sample will do much good.

FUNGI AND FUNGICIDES. A practical manual concerning the fungus diseases of cultivated plants and the means of preventing their ravages. By Clarence M. Weed. New York: The Orange Judd Co. 1894. Pp. vii, 228. Price $1.

The author claims that the enormous loss inflicted on plants by fungi in America might be saved in large proportion by the application of the various preventives and remedies now known to be available. This book claims to tell the farmer how to keep down the diseases which ruin his crops and also describes the diseases themselves so that they may be diagnosed as well as cured. Numerous illustrations will go toward making the book quite popular and very useful.

THE PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. By Francis B. Crocker and Schuyler S. Wheeler. With a special chapter by H. A. Foster. New York: D. Van Nostrand Co. Strand, London: E. & F. N. Spon. Pp. 205. Price $1.

This volume the authors state to be simply the groundwork of a larger and more complete treatise which they are preparing, and for which they invite suggestions. Testimony to the valne of the work is accorded not only by the names of the authors, but by the very practical treatment of the subject and because it is designed for everyday use of the dynamo.

PRACTICAL INSTRUCTIONS IN QUANTITATIVE ASSAYING WITH THE BLOWPIPE. Containing also readily applied qualitative blowpipe tests. By E. L. Fletcher. First edition, first thousand. New York: John Wiley & Sons. 1894. Pp. vi, 142. Price $1.25.

There is something fascinating in the application of the blowpipe to quantitative assaying. This volume in small space covers both qualitative and quantitative work.

THE DISEASES OF THE WILL. By Th. Ribot. Authorized translation from the eighth French edition. By Merwin Marie Snell. Chicago: The Open Court Publishing Co. 1894. Pp. vi, 134. Price 75 cents.

The science of the alienists is here treated. It is written from a popular aspect and at the same time is based on the most advanced views. It will repay very careful perusal. Its chapters on the impairment of the will and on the impairment of voluntary attention reveal very peculiar and disagreeable phases of human nature.

THE PSYCHOLOGY OF ATTENTION. By Th. Ribot. Authorized translation. Second revised edition. Chicago: The Open Court Publishing Company. 1894. Pp. vi, 115, cloth Price 75 cents.

This second work of Dr. Ribot's can be taken as representing more positive and normal actions of the mind than those described in the one just reviewed. Like its predecessor, it will repay careful reading by all. It is an effort in the study of the most complex subject of our actual daily experience, the mind of man.

METALLURGY OF GOLD. By T. Kirke Rose. Being one of a series of treatises on metallurgy, written by associates of the Royal School of Mines. Edited by Prof. W. C. Roberts-Austen. London: Charles Griffin & Company, Limited. 1894. Pp. xvi, 462. Price $6.50.

We here have Professor Austen acting as editor of a series of books, the present volume being written by one who has had practical experience of gold and silver abstraction in the western part of this country. The combination is a good one; the practical knowledge of the author under guard of Professor Austen's high theoretical knowledge is a guarantee that the work is a good one. It has an excellent aspect and must be regarded as an important accession to the metallurgical library.

PLANE TRIGONOMETRY. By S. L. Loney. Part II. Cambridge: At the University Press. 1894. Pp. xxvi, 480. Price $1.

DIE PHOTO-GALVANOGRAPHIE ZUR HERSTELLUNG VON KUPFERDRUCK UND BUCHDRUCKPLATTEN. By Ottomar Volkmer. Halle a. S.: Wilhelm Knapp. Pp. 94; 16 figures and 7 sample plates. Price $2.40.

This book forms the sixth volume of the Encyclopedia of Photography, and treats the reproduction of copper and other plates by galvanoplastic processes in a very exhaustive manner. The sampleplates can be considered gems of the art. A photogravure of the inventor of photo-galvanography, Mr. Paul Pretsch, forms the title picture.

MISERFOLGE IN DER PHOTOGRAPHIE. By H. Muller. Halle a. S.: Wilhelm Knapp. Pp. 72; 9 test figures. Price 80 cents.

This little book treats on unsatisfactory results in photography and remedies for the same. and will no doubt be a welcome guide for amateurs. and even professionals. to enable them to produce photographic pictures perfect in every respect.

MIKROPHOTOGRAPHIE UND DIE PROJECTION. By Dr. R. Neuhaus. Halle a. S.: Wilhelm Knapp. 1894. Pp. 58; 5 illustrations. Price 40 cents.

This book treats microphotography in such a popular way that even a beginner, by following the rules laid down, will soon be enabled to produce satisfactory pictures. The second part of the book gives a description of how to project prepared microscopic objects on a screen.

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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.

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(6143) E. A. C. says: Given an old-fashioned breast water wheel 8 feet diameter, head and fall 6 feet, gate about 12 inches under top of water, what would be the proper speed of wheel at circumference? or the number of revolutions per minute to get best effect of water? A. The wheel should have one-half the rim speed due to the velocity of the water under the gate head, which is 8 feet per second theoretically, but practically only 6 feet. The wheel rim for best effect should have a velocity of feet per second, or 7½ revolutions per minute.

(6144) G. H. F. writes: Will you kindly decide a matter between A. and B.? A. asserts that the receiver of a rain gauge placed horizontal, gathers all the rainfall, even though the wind deflects the rainfall 45 degrees. B. claims such deflection (45 degrees) would cause a large portion of the rainfall to go over the receiver, as a less area would be presented to catch the rain. Which is right, and why? A. B. is correct. The effect of a slanting rain on the actual rain catch is the same as if the gauge was turned up to an equal angle for a vertical rainfall. The difference in area of gauge is equal to the difference of area between a circle and an ellipse, proportioned on the angle of descent of the rain drops.

(6145) F. J. H. asks: What is the best way to learn to read mechanical drawings? Is there any book that will give this information to one who does not care to take a course in drawing? A. There is no better way of learning to properly and correctly interpret the exact meaning of mechanical drawings than by making a study of mechanics and practice in drawing. Familiarity with drawings and personal explanation of their meaning from a draughtsman will do much to give you a general idea of the methods of expression in mechanical draughting, but it is only a superficial education. You can also do much toward this yourself by a study of books on draughting.

(6146) F. E. D. says: To settle a dispute will you please answer through your paper which has the most traction surface on the rail, a locomotive with 3½ foot drive wheel or one with 7 foot driver, the weight being the same? A. The larger wheel has the largest bearing surface, but as surface does not count in friction with a given weight, the smaller wheel will have slightly the greatest pull because of the increased bite on the rail, due to smaller bearing surface.

(6147) R. P. J. asks: 1. What should be the specific gravity of the liquid in storage battery? A. Uncharged 1·170; charged 1·210. 2. How long should 26 cells, each 4 plates, 4 inches by 5 inches, light one 16 candle power 50 volt lamp? A. Ten hours.

(6148) L. L. Y. asks: Please tell me how the gear of bicycles is calculated? A. Divide the number of teeth on the large sprocket by the number on the small, and multiply the quotient by the diameter of the driving wheel.

(6149) O. L. S. asks: 1. A says that No. 12 wire has only twelve times more electrical carrying capacity than No. 36 wire. B says that the electrical carrying capacity of No. 12 wire is more than twelve times greater than that of No. 36. Which is right? A. No. 36 wire, 0·04 ampere; No. 12 wire, 10·2 amperes. 2. What number of Crowfoot battery cells would be required to fuse No. 12 wire? A. It depends on the material of the wire and its length. In any case it would be a very large number. For copper wire allow.

Communications Received.

"On Mr. Garner and Simian Speech."

"On Nature's Most Invincible Creatures." By E. M. A.

"On a Sunken Double Tubular Railway Across the English Channel."

"On Isaac Pitman." By S. M. M.

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Safe locking mechanism, C. O. Yale ... 521,842
Sash cord fastener, L. H. Mullikin ... 521,806
Sash lock, lifter, and holder, Guy & Reed ... 521,955
Seaming machine, can, J. W. Roberts ... 521,894, 521,895
Seat, O. L. Barrett ... 522,142
Seed, machine for cleaning cotton or other, M. Moran ... 522,179
Separator. See Magnetic separator.
Sewing machine, P. Gohring ... 521,855, 521,856
Sewing machine for fringing fabrics, G. A. Judson ... 521,962
Sewing machine shuttle, H. A. Bates ... 522,002
Shade holder, window, A. B. Dunkle ... 521,784
Shaft holder, vehicle, P. J. Harrah ... 522,114
Shears. See Tinner's shears.
Shell, R. A. Hadfield ... 522,012
Shoe, E. L. Godin ... 521,789
Shut-off device, pipe, J. F. Nelson ... 521,938
Side light, C. Anderson ... 521,777
Signal. See Grave signal.
Signal operating wires, compensator for, J. S. Lyman ... 521,885
Signaling system and apparatus, electric time, W. A. Purcell ... 522,029
Skirt and trousers, combined, Zeller & Crager ... 521,998
Sled, J. Hofer ... 522,060
Sleigh runner attachment, H. J. Howard ... 521,794
Smokestacks, device for increasing draught in, R. Gaul ... 522,009
Soap lye, recovering products from spent, J. Van Ruymbeke ... 522,134
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Soldering tool, electric, J. F. McLaughlin ... 521,914
Sole cutting machine, J. J. Heys ... 521,793
Sole rounding machine, J. N. Moulton ... 522,166
Sound conducting apparatus, G. A. Leech ... 521,800
Stamp, return postage, R. S. Williams ... 522,037
Stand. See Model stand. Trolley stand.
Steam, apparatus for preparing expanded and reheated, F. L. Dyer ... 522,157
Steam boiler, H. N. Barth ... 521,844
Steam boiler, T. Miller ... 522,077
Steam boiler, F. Prox ... 521,812
Steam boiler, water tube, L. D. Davis ... 521,850
Steam boiler, water tube, J. W. Van Dyke ... 522,035
Steam, preparing, J. Van Ruymbeke ... 522,095
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Steam trap and feeder, D. L. Long ... 522,020
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Stilt, E. Piepenbring ... 521,811
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Stove, heating oil, V. E. Randall ... 521,813
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Submarine boat, Freese & Gawn ... 521,854
Sulky, S. Elliott ... 521,878
Sulky, pneumatic, G. W. Clarke ... 522,150
Switch. See Railway switch.
Switch operating device, W. F. Dermody ... 522,109
Switch operating mechanism, automatic, C. P. Bachelder ... 522,096
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Tellurian, G. B. Nichols ... 522,082
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Tool handle, L. H. Schmitt ... 532,031
Tool holder, J. E. Smith ... 521,965
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Traction engine, C. Quast ... 521,988
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Umbrella, self-closing, J. H. Sprague ... 521,828
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Valve mechanism, W. B. Mason ... 522,071
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Water closet seat, U. G. Johnson ... 522,163
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Wheel rim and making same, C. F. Cowdrey ... 522,047
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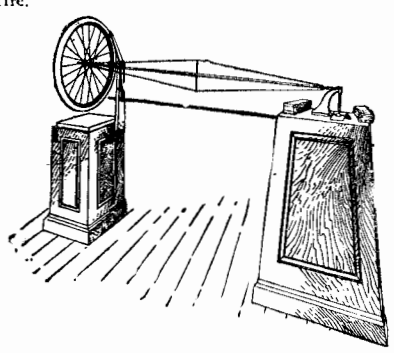

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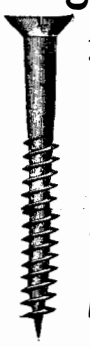

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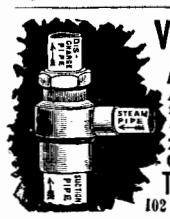

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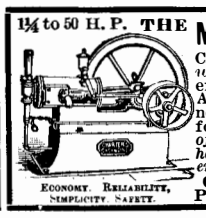

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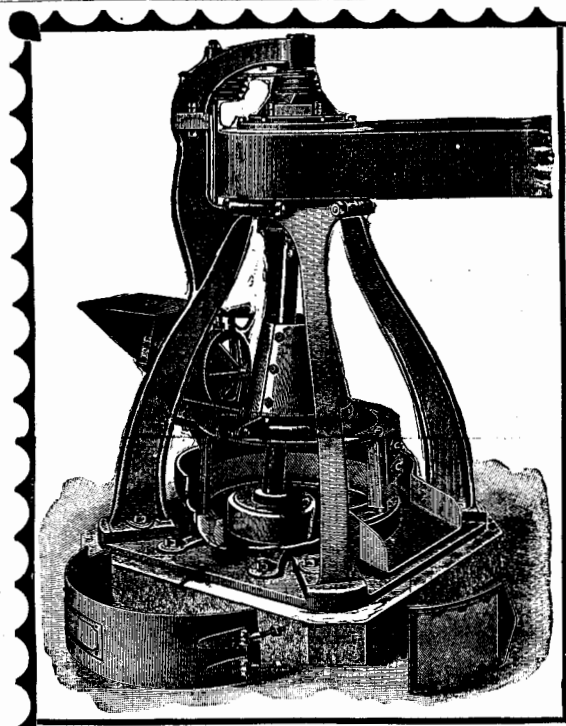

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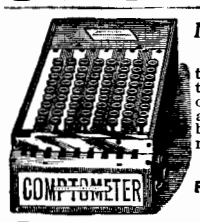

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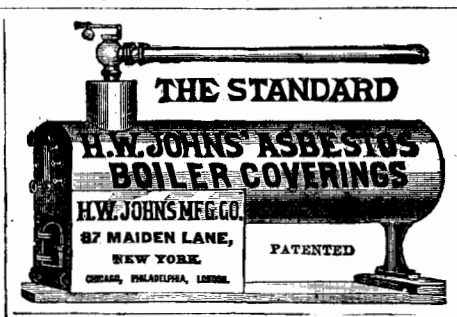

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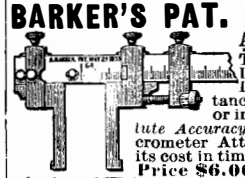

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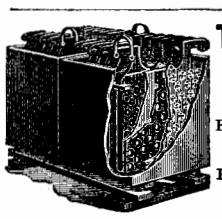

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