SCIENTIFIC AMERICAN

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THE NEW RACING SLOOP YACHT ATLANTIC.

The yacht Atlantic was successfully launched on May 1 from the shipyard of her builder, Mr. John Mumm, at the foot of Fifty-fifth Street, South Brooklyn. Her keel was laid in February last.

The new clipper has been built after the designs of Captain Philip Ellsworth by a syndicate of yachtsmen composed of prominent members of the Atlantic Yacht Club.

Her length over all is 95 ft. 7 in., and on the water line 84 ft. Her extreme beam is 23 ft. 2 in. The hold is 10½ ft. deep, and the draught of water 8½ ft. We illustrate her outline in plan and elevation. In cross section her lines are full and well rounded, the angle at the keel being noticeably blunt. The characteristic feature in the construction of the yacht is the extreme lightness of the materials employed. The frame is made of oak and black larch, and the ceiling of Oregon pine. The clamps are of yellow pine. Her outside planking is also of Oregon pine, with the exception of the three upper strakes, and is 2½ inches in thickness. Many of these planks have been cut from mast stuff, and are fifty to sixty feet long. In the interior, metal knees made of cast steel, 4 by 1¼ inches, are used to resist the racking strain of her spars. Wooden hanging knees on each side support the strains on her deck. A shelf of yellow pine running round her side and under her beam ends will meet the torsional strains brought to bear upon her frame.

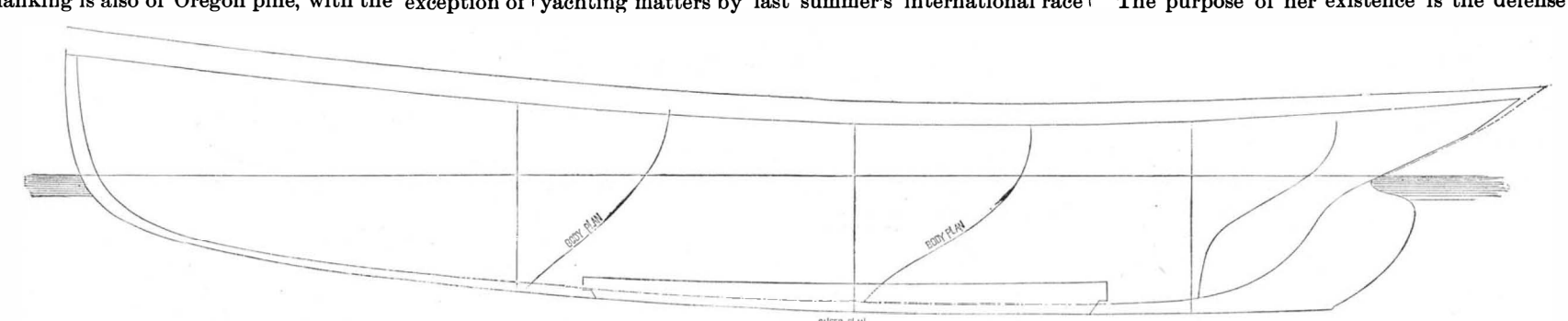
At the time of the launch, she had only her bowsprit in, and had a mean draught of 6 feet and 4 inches. Thirty-four tons of lead form the ballast on her keel. The casting and handling of this immense piece was a matter of some difficulty, but was successfully accomplished by building a mould directly under her timbers.

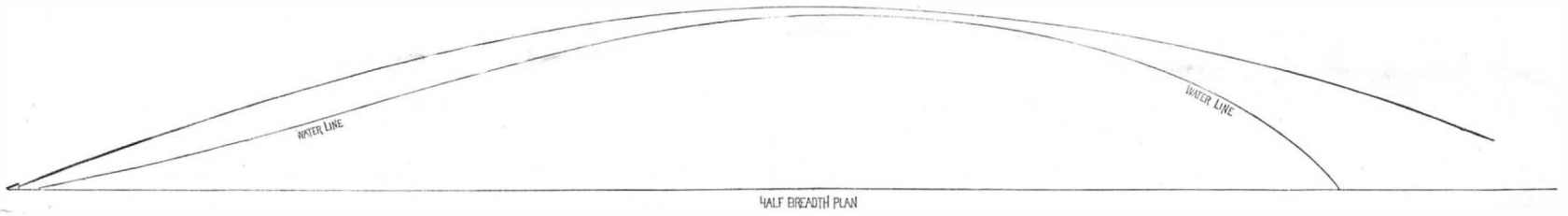
It is estimated that the total ballast will be about forty-five tons. We have secured a very spirited picture of the yacht just as she is about to take her first plunge into the waves. The lively interest excited in yachting matters by last summer's international race was shown by the large crowds that have watched her evolution and were on hand at the christening. Much admiration was expressed for the graceful lines, and particularly for her light flotation.

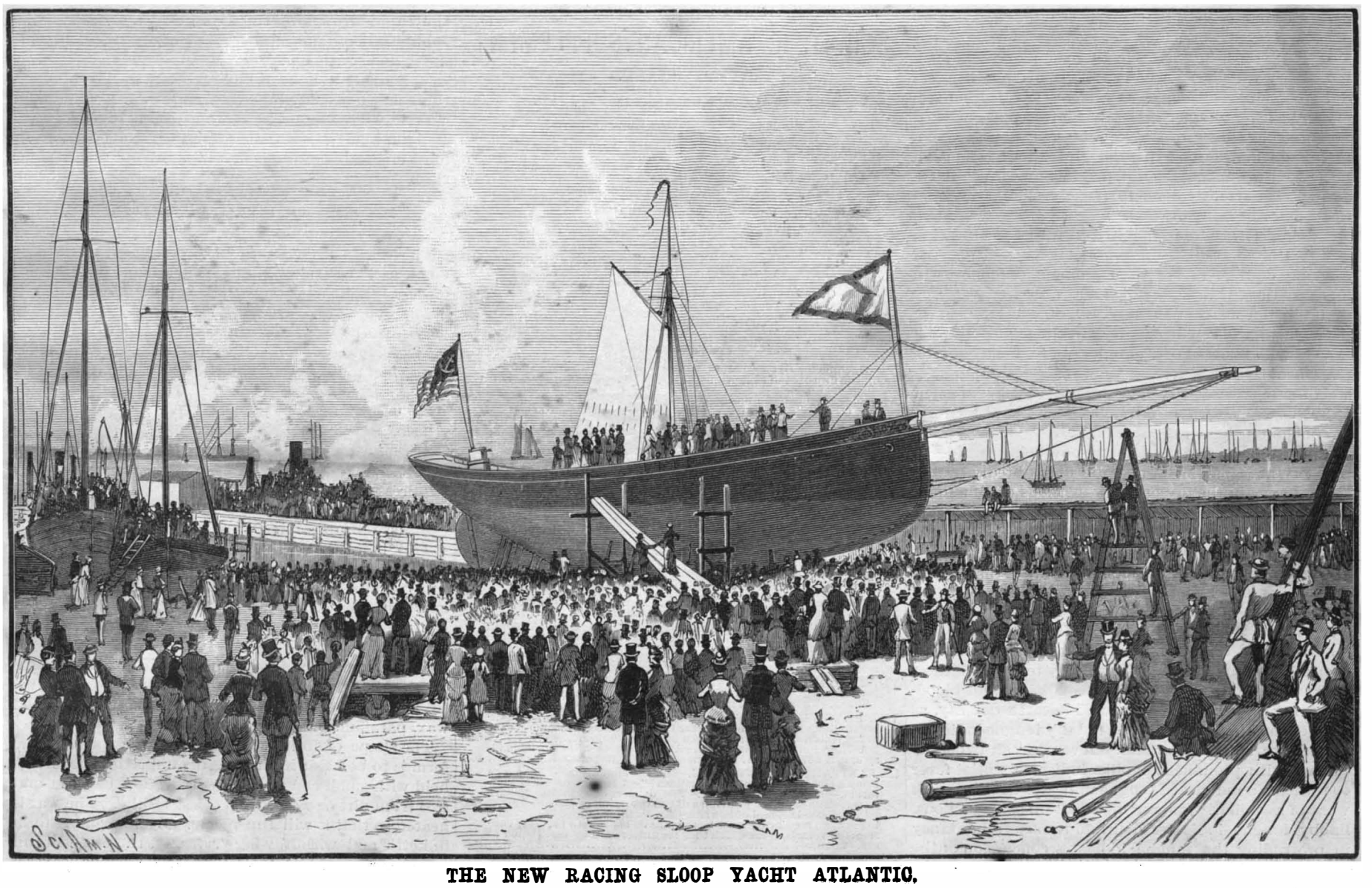
Her sail power will be very large. The mainmast is 50 feet, with a gaff of 47 feet and a boom of 76 feet 6 inches. Her suit of racing sails numbers 15. They have been specially woven for the Atlantic, and vary in weight from the heaviest duck to the lightest cotton drillings. The spread of the mainsail is 4,000 square feet, and that of the large jib 1,150 feet. The club topsail adds 1,560 feet to her sail area, and the balloon jib topsail, intended for gentler breezes, 4,180 square feet. Her spinnaker boom is 72 feet long, and carries a sail of 4,400 square feet.

Such are the main dimensions and features of New York's representative clipper yacht. She is to all appearances a thorough-going racer, and has been built for work.

The purpose of her existence is the defense of the







THE NEW RACING SLOOP YACHT ATLANTIC.

America's cup, for which the British cutter Galatea is now the avowed competitor. Whether the Atlantic will fulfill her mission, and win the honorable office of defending the cup, will be determined by the preliminary races between the four competitive American clippers, the Puritan, Priscilla, Mayflower, and Atlantic. Each boat has its champions, but they are all so admirable that the most experienced yachtsmen hesitate to express any opinion about the result of the forthcoming trials. The success of the Puritan has made the superiority of the centerboard over the cutter a foregone conclusion in the minds of nearly all American yacht owners. This confidence has made the interest in the national contest much more lively at present than in the real contest between the American champion and the British challenger. Apparently, everything possible has been done to make the successful clipper, whichever she may be, a worthy representative of the most advanced principles of American yacht building.

Iron Foundations for Heavy Guns.

In case of a war with foreign powers, we should be forced to the rapid construction of temporary fortifications behind earthen parapets. One of the great difficulties in the way of such construction is the time required for building properly the heavy, massive masonry foundations up to this day regarded as necessary under heavy guns. This difficulty may be now avoided (according to Captain W. H. Bixby, Corps of Engineers, U. S. Army) by the use of wrought iron instead of masonry for these foundations.

Captain Bixby proposes to replace the present slowly built, difficultly moved, difficultly releveled masonry foundations for heavy guns behind earthen parapets by rapidly constructed, easily moved, easily releveled wrought iron foundations, to rest on cross girders or sleepers, embedded in the earth of the *terre-plein*, and provided with a front parapet anchorage sufficient to resist all direct recoil.

The holding power of anchorages embedded in mere earth is well known by the experiments of our Q. M. Department on suspension bridge anchorages during the war of 1861-65, and it is also well shown by the Shoeburyness experiments of 1881 (see p. 41, Part 2, of Captain Bixby's report on "Sea Coast Fortifications in Europe").

A 40-foot earthen parapet and suitable iron rod and cross girder anchorage may well be trusted to resist and absorb all the direct horizontal recoil of even a 100-ton gun, leaving to the foundation alone the lighter duty of supporting the carriage and gun and the comparatively small vertical component of the recoil.

An iron girder foundation, resting on sleepers and earthen bed, may be fairly well trusted to serve as an efficient support to the vertical weights and blows of our heavy guns, after the first few rounds have been fired. A little unequal settlement may naturally be expected, but such settlement is of minor account today, for two reasons: first, heavy guns of the present and future must be traversed by machinery, and such machinery will overpower the slight extra resistances due to unequal settlement of the gun's platform; second, whenever an unequal settlement becomes marked and objectionable (probably not oftener than once in a month during action), the iron girder foundation can be jacked up and earth tamped in underneath it (exactly as is currently done to remedy similar unequal settlements of railroad tracks).

It seems now quite probable that future fortification in the United States (when it does come) will demand economy of time rather than economy of money. In any case the advantages which may arise from rapidity of original construction, rapidity of construction in place, facility of repair, facility of change of position if necessary to allow of other angles of fire, facility of replacement if necessary to allow of guns of greater weight and size—all these advantages appear sufficient to authorize at least the trial of such a foundation under one of our heaviest guns.

Captain Bixby's suggestions are now being considered by the War Department, and will undoubtedly lead to some change in the present slow methods of gun foundation construction.

The Tongue in Disease.

One of our medical contemporaries states that different complaints are indicated by the condition of the tongue, as follows:

A white-coated tongue indicates febrile disturbance; a brown moist tongue indicates disordered digestion or overloaded primæ viæ; a brown dry tongue indicates depressed vitality, as in typhoid conditions and blood-poisoning; a red moist tongue indicates debility, as from exhausting discharges; a red dry tongue indicates pyrexia, or any inflammatory fever; a "strawberry" tongue with prominent papillæ indicates scarlet fever or rotheln; a red glazed tongue indicates debility, with want of assimilative power of digestion; a tremulous, flabby tongue indicates delirium tremens; hesitancy in protruding the tongue indicates concussion of the brain; protrusion at one side indicates paralysis of the muscles of that side.

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NEW YORK, SATURDAY, MAY 22, 1886.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 542.

For the Week Ending May 22, 1886.

Price 10 cents. For sale by all newsdealers.

AN UNDERGROUND RAILWAY FOR NEW YORK CITY.

In March, 1870, the SCIENTIFIC AMERICAN published illustrations of an underground railway which had then been built, for a distance of one block, under Broadway, New York. It was known as the Beach pneumatic tunnel road, the cars to be propelled by compressed air, but was never completed, except for a distance of about two hundred feet. From that day to this, the project of an underground Broadway railroad has come up at almost every session of the State Legislature, until a bill for this purpose has at last been passed, and received the Governor's signature. There are said to be grave doubts about the constitutionality of the act, which will have to be settled before the work of building is actually begun, but the names of the eminent capitalists and business men connected with the enterprise afford an assurance that this great undertaking will now be prosecuted in earnest.

By the plan adopted, the company is allowed forty-four feet under the surface, the least width between the sidewalks on Broadway being, for a short distance, thirty-nine feet, and the average width being about forty-nine feet. The sewers, water, gas, and steam pipes, with tubes for wires, etc., are to be carried in vaults and subways of brick or iron, to be built and kept in repair by the company; they are to be open for entrance at every quarter of a mile distance, and it is estimated will cost $400,000 a mile. This will, of itself, be a great saving to the city, and obviate the necessity of the frequent tearing up of the pavement, at present so great a source of public inconvenience. The kind of power to be used is not specified; it may be electricity or any motor not emitting smoke, gas, or cinders.

During construction, a temporary bridge is to be maintained over all places where the work is going on, so that travel will not be interfered with during the progress of the work. The road is to extend under Broadway from the Battery to Fifty-ninth Street, a distance of about four and a half miles, with a branch at Madison Square to Forty-second Street, but both of these lines to be further continued, if found desirable, in the future. The sections named are to be completed within five years, and the city is to receive for the privileges granted three per cent. of the gross revenue. The capital stock of the company is fixed at $25,000,000, and the cost of building is variously estimated at from $3,000,000 to $6,000,000 per mile.

The only work in the world at all similar to this proposed arcade subway under Broadway is the underground railway system of London, by which that city is belted by a nearly complete double circle of subterranean roadway, though with many open cuttings within high walls. These underground roads cost from two and a half to four million dollars per mile, and pay from three to four per cent. interest on the capital invested. Although the total population of London is more than four millions, while that of New York should not be placed higher than probably one-third of this, the rapid growth of the latter city, and its peculiar configuration, determining most of its travel in main north and south lines, seem to indicate that the new road is likely to have as large a business, in proportion to its mileage, as its London predecessor. Let us hope that it will, also, be as well and solidly built, for the London road is, both in its building and operating, a most creditable example of a high order of engineering skill.

PROGRESS OF INDUSTRIAL ELECTRICITY.

"How was that made?"

This question was asked of a prominent metal merchant as a vessel was handed him, made in the shape of a head-light reflector. It was composed of copper about one sixty-fourth inch thick, tough, pliable, and very smooth on the inner surface. Examining the edges of the flange, the merchant noticed that the thickness of the metal did not vary in the least around the entire rim.

"It was spun."

"No."

"Stamped."

"No."

"Pressed."

"No."

"Cast? Impossible."

"No, it was not cast."

"Then it must have grown."

It had grown, but it was with the rapidity that only electricity can give to growth.

The process by which the above casting or vessel was made is as follows:

A rigid male form is made of the approximate shape and less in size than the article wished to be reproduced. This form is then immersed in a kettle of refined wax, paraffine, or similar substance.

The shape of form will decide in what position the form is to be held; in the case of a reflector, the form is held with small end up. The wax must be pure, and free from dirt or water to get best results. The wax is heated so that it will run nicely. By immersing form in kettle and withdrawing vertically, the wax will run smoothly, and as it cools in a few seconds leaves a smooth, true surface. This surface is now rendered

conductive with the well-known electrotyper's process, by the application of black lead, iron filings, and blue vitriol. The whole thing is then immersed in a copper solution, and connected electrically with a dynamo. Copper anodes are also put in solution, and connected electrically with opposite pole of dynamo. The dynamo is set in motion, and the "growth" of a vessel begins. The thickness of vessel is dependent upon the length of time deposit is allowed to continue; pieces of copper an inch thick have been made. The time required to make a vessel of a certain weight and size depends altogether upon the size of the dynamo. The perfection and strength attained by these "electric engines" through the perseverance of recent inventors and manufacturers is something marvelous. The Brush people of Cleveland are now building a dynamo which will have a current strength of 122,500 amperes. A current strength of 386·4 amperes will deposit 1 pound of copper per hour. This large dynamo, then, will deposit over 315 pounds copper per hour—3,150 pounds in a run of 10 hours. The weight of copper in reflectors will average 14 pounds; 225 reflectors can be made in 10 hours, or about 6,000 per month.

The output of the United States averages between 5,000 and 8,000 reflectors per annum. Given the required number of forms, a dynamo of above size and a few workmen will turn out in 30 days what now requires the use of many spinning lathes and other machinery and the entire time of many workmen. Electro deposit is crystalline in its nature, and therefore the conclusion is hastily jumped at by many men that vessels made in this way will necessarily be porous. The advances made in this point are as marked as those in the development of the dynamo, and the casts properly made by above process are as ductile and pliable as the finest rolled sheet copper. In examining the digest in the Patent Office on electro deposition, it was found that the idea of making reflectors and other copper wares by electro deposition was an old one, patents having been issued to foreigners as early as 1841 and 1842. At that time the dynamo was scarcely in existence, and the point of failure in the practical application of their specifications lay in the fact that they failed to see that unless moulds could be formed quickly and cheaply, the idea was useless. To bring out this point clearly, let us go back a little; when the vessel has acquired the necessary thickness, the form and vessel are removed from the bath, and a slight pressure is brought to bear upon the vessel or hot water is poured over it. This will loosen the wax, and allow the vessel to be removed.

The original or principal form is made of wood, clay, earthenware, glass, brass, copper, or of any substantial material. It will be at once seen that it is only necessary to immerse this original form in the wax again to prepare it for another cast. In the patents above referred to, granted in 1841 and 1842, the forms are composed of either wood, clay, brass, etc., but are composed entire of one material or substance, requiring for the removal of vessel the destruction or mutilation of mould, necessitating a new mould for each vessel made. This method was too expensive to be practical, and the process was abandoned.

The above new method of preparing moulds is fully covered in letters patent recently issued to a Western inventor. Electricity is surely taking the lead in valuable inventions, and this promises to do away with much time and labor. It will also introduce some new and important articles upon the market.

It is well known that it is an impossibility to cast copper in thin sheets, and rolling is expensive. As the forms in above process may be of any size or shape, a burial casket may be made in one piece, of copper, and at a much less cost than if cast from iron, as now made. Probably the greatest revolution which this process will bring to the commercial world will be in the plumbing goods line. Instead of having to roll sheets of copper, then cut them to exact dimensions, and then solder together to make a bath tub, an entire shell will be made in one single piece, set in a wooden frame, and a far better and probably cheaper bath tub will be the result. Linings for flush tanks will come under the same change.

A Belt Carries Fire through a Mill.

On the morning of the 21st ult. the Merchant mill of Pennsylvania Steel Works, at Steelton, Pa., was completely destroyed by fire. The mill was an immense wooden structure, with iron roof, 100 feet wide by 400 feet long. At 10:30 o'clock in the morning there were 312 men at work. A boy who wanted to fill his torch with oil went to the pump house for that purpose, and while thus engaged the torch exploded, and the lad tried to stamp out the flame. In doing so he scattered the blazing oil, and the fire was communicated to the barrel of oil, which stood under the belt that ran from the pump house to the main mill and furnished the motive power for the machinery. The flames shot up from the burning oil barrels, and set the oil-saturated belt on fire, and in an instant the moving belt dragged a trail of fire into and clear across the mill, communicating flame to whatever it touched, and making a display of fireworks gorgeous but costly.

American Clays, and Their Use for Constructive Purposes.

In addition to the localities already known, further geological researches have disclosed the occurrence of large deposits of brick clay in different portions of Maine, and particularly along the Kennebec and Penobscot rivers. Deposits have also been found in Augusta Co., Va., producing both fire and potter's clays; at Birmingham, Ala., and in several new localities in Ohio and New Jersey. No new finds are reported in the Rocky Mountain division, but in California clay deposits of some importance have recently been discovered in several portions of the State. An excellent quality of kaolin, or porcelain clay, occurs at Calico, in San Bernardino Co. Clays suitable for making the coarser kinds of pottery have been found in a number of localities, stretching from the Oregon line to Lower California.

With the greater diversity shown by American industries, the uses for clay have largely increased, until now a long list of articles is made exclusively of this material. The processes of manufacture differ both with the quality of the crude article and the uses to which it is to be put. They have just now, however, a greater interest than usual, since the high price of lumber and the desire to make our structures more fireproof than formerly have operated to invest all mineral constructive materials with an increasing importance. In the manufacture of common brick a great variety of clay is employed, but that containing much lime is avoided, since it would be made caustic by burning, and its subsequent hydration on exposure to the atmosphere would cause the bricks to crumble.

Particles of stone or iron pyrites are also removed to prevent trouble in the after working. When partially dry, the clay is ground in roller mills, and then mixed for use. The mixing is necessary to produce a homogeneous and, consequently, a durable product. When this process is completed, the clay is moulded into bricks, either by hand or machinery.

It is said that an experienced moulder with proper assistance can make 2,000 bricks in a day, when working by hand. The moulded bricks are permitted to partially dry in the sun, and are then stacked in kilns for burning. The fuel varies, but when available, anthracite screenings are usually employed. With coal, the burning requires from four to six days, and the cooling of the kiln about the same time. Building brick for city fronts, and the better class of work, are made in the same manner, except that better clay is used, and the operations are more carefully performed. Pressed brick, such as is made at Baltimore with success, are moulded larger than required, and then compressed to the proper size in a brick press. The color and smoothness depend upon the moulding sand employed. All of the operations are conducted under cover, and the bricks are laid on their faces in drying, instead of on end, as with the commoner kinds. Special precautions are also required in firing. The arches and four or five lower courses are made of common brick and the pressed brick on top of these. The burning requires from ten to twelve days. The bricks are allowed to cool slowly, and when taken from the kiln are sorted, the defective ones being rejected. The ornamental and intaglio bricks now so popular are made in a similar manner, save that even greater care is required.

Glazed brick are now largely used for both interior and exterior decoration. They are manufactured in Ohio and elsewhere in the United States. For this purpose an ordinary red or light colored brick is used, and a suitable enamel produced on the surfaces to be exposed. Some colors are very easily obtained. A simple lead glaze on a cheap buff fire brick makes a good yellow- A manganese and iron glaze is used for black. White and blue are the most difficult to produce, since the red color of the ordinary brick must first be hidden by an opaque layer of white before the finishing glaze is applied. Green must be made in the same way.

Roofing tiles are made by ordinary brick clay. This is first moulded into strips, about six inches wide and three-eighths of an inch thick, and is then cut into desired lengths. Oil is used to keep the clay smooth and prevent the plates from sticking. A specially devised machine then trims off the edge of the plate to a symmetrical shape, and presses it to the desired pattern. It takes about two weeks in a steam heated chamber to dry the tiles, as the oil hinders the escape of moisture. They are piled loosely in a kiln, to a depth of six feet, and subjected to a slight firing. Several designs of tile are made. The shingle tile is simply a slab of burnt clay, 12 x 6 x ⅜ in., having suitable holes for the nails to pass through, which hold them to the roof. The diamond tiles hook into each other and are more ornamental, but less durable. The chief objection to roofs of this character is in their excessive weight. A ten foot square of plain shingle tile weighs about 1,100 pounds; of the diamond tile, from 650 to 850 pounds.

The manufacture of door knobs, as carried on at East Liverpool, O., is of considerable interest, since it requires a careful mixing of the different clays to obtain a well marbled product. Each color of clay is worked separately and is first put through a process called boiling. A vertical cylinder, about six feet in diameter, and carrying in the center a revolving rod provided with stirring and cutting arms arranged spirally, is filled with the requisite amounts of water and clay. It is then set in motion by horse power, and the clay beaten to a thin mud or slip. This is run through a fine bolting cloth into a large tank, from which it is dipped into an evaporating pan, heated by suitable furnaces. When removed from the pan, the clay is soft and plastic, and is piled up and covered with wet blankets to keep it tempered. The clay, when ready for use, is "wedged." A block of both colors is cut by a wire into six or eight layers each, which are piled alternately into a new block of double the size. This is thrown down with violence to consolidate the layers. It is then cut and wedged and so on until the colors are marbled in fine alternating streaks. Thus prepared, the clay is moulded into proper shape by stamping in a die. The knobs are dried, and when somewhat hard are turned to a smooth, regular face. They are then thoroughly dried and burned twice—once as biscuit, and then dipped in glaze and burned again.

A terra cotta lumber has recently been added to the list of mineral building materials. A kaolinite of good quality is mixed with sawdust, worked by machinery into slabs, and is then burned, sawed, and dressed. It is, in this condition, ready for market, and is said to be indestructible by fire, water, or gases. It is a poor conductor, and suffers but slight expansion or contraction with changes of temperature. Its weight is put down at one-half that of brick. It can be worked with edge tools, bored, and sawed, and holds nails as readily as timber. It is also made into hollow tile and fireproof casing. Mr. Wilbur's report to the Government, from which our information is taken, also gives the statistics of production of the United States, together with the imports and exports.

A Child Woman.

The recent death of Miss Caroline Terboss has attracted renewed interest in her remarkable case. She was a member of an otherwise normally developed family, and up to her twelfth year she was apparently like other girls. But at that age she suddenly stopped growing, and though she lived to the advanced age of seventy-seven, development, once interrupted, was never resumed. At the time of her death, she was in form, stature, and organization a child. For many years she was a familiar figure on Fifth Avenue in the neighborhood of the reservoir. Her age was a mystery, for her hair remained unchanged in color, and her face, though noticeably mature for so young a figure, was but slightly wrinkled. Beyond an extreme sensitiveness of the skin, she enjoyed apparently good health until within a short time of her death. Her height is given at but four feet and four inches. She is stated to have been remarkably quick intellectually. As no physician had been in attendance within twenty-four hours of death, it was necessary to summon the coroner. The autopsy revealed the perfectly formed body of an apparent girl of eleven. Beyond certain organic peculiarities, the anatomy was normal. The spine was straight, and there was no outward deformity. No examination was made of the brain.

The case attracts much interest among physicians, because, though similar instances have been recorded, they are very rare, and never has the subject lived to so advanced an age. Death has usually occurred before twenty-one. Twenty-five years of age is believed to have been the extreme limit.

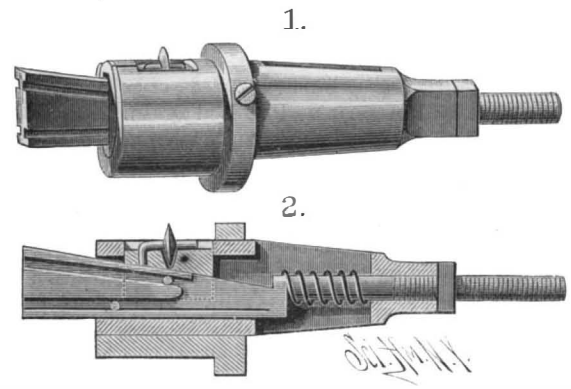
The Telephone Nut Shell.

A large number of German publications printed from 1860 to 1865 contain accounts of the transmission of words and articulate speech by Philipp Reis with electricity, and the instruments as made by Reis do now transmit and receive articulate speech clearly and distinctly, and I maintain that if only five words were so transmitted the discovery of its being done with electricity by Philipp Reis is conclusive, and that no honest or intelligent person can concede to Bell what was done and given to the world unconditionally 15 years before by Philipp Reis. All subsequent efforts are merely mechanical improvements, and no honest man acquainted with the subject can dispute the discovery by Philipp Reis. W. VAN BENTHUYSEN.

THE President in a message to the House has suggested that the 3d of September be set apart as an appropriate day for the inauguration of the Bartholdi statue of Liberty. This day is selected as being the anniversary of the signing of the treaty of peace at Paris, by which the independence of the United States was recognized and secured. He asks that a sufficient amount be appropriated by Congress for the suitable recognition of this event. It is very encouraging to believe that the completion of this great work, begun so many years ago, is really at hand. The pedestal is quite finished, and presents a splendid appearance, looming up, as it does, above the old fort on Bedloe's Island in its solitary grandeur.

IMPROVED TUBE CUTTER.

The accompanying engraving represents an implement for cutting off boiler tubes within the boiler, in case the tubes must be removed. This tube cutter is the invention of Mr. John C. Mineo, of Bunker Hill, Ill. The tubular stock is formed with a tapered shank, provided at its end with a squared part fitting a key, by means of which the stock can be turned. In the stock is a longitudinal slot, and in the shank is a slot extending entirely through it, as shown in the sectional view, Fig. 2. Passing through the stock is a wedge piece, provided with a groove along its beveled edge and along its straight edge. In the slot in the stock is a block having a groove in its bottom for receiving the beveled edge of the wedge piece. Pins from the sides of the groove pass into the upper grooves in the wedge piece, and pins from the sides of the stock enter the lower grooves. A cutting disk is pivoted in the block.

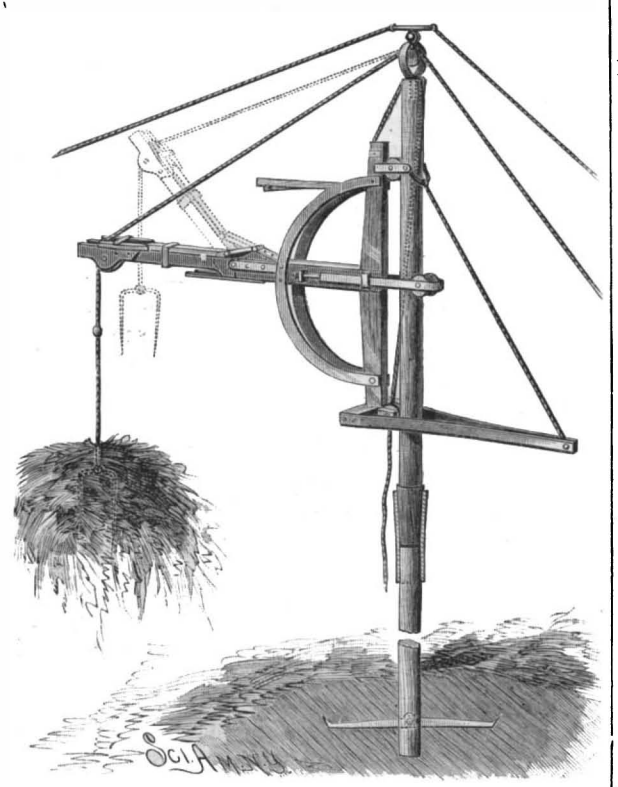


MINEO'S IMPROVED TUBE CUTTER.

A stem projects from the inner end of the wedge piece through the shank, and has its outer end screw-threaded to receive a nut. A spiral spring on the stem presses the wedge piece out. Before inserting the implement, the wedge piece is so moved as to draw the block into the stock until the cutter does not project. The implement is then inserted and the nut is turned to draw the wedge piece in the opposite direction, thereby forcing the block outward and pressing the cutter against the inner surface of the boiler tube. The key is then pushed from the nut to the squared part of the shank and the tool turned, the cutter cutting into the tube. The cutter is gradually moved outward by turning the nut. In case the tube has a greater diameter than the stock, an eccentric sleeve, having a flange, is slipped on the stock and is held in place by a binding screw.

HAY STACKER.

To the lower end of the pole, which is made in two or more parts united by ferrules, are pivoted the inner ends of two prongs so formed that when the end of the pole is pushed down into a heap of hay or straw they will be forced into a horizontal position, and thereby form a rest for the pole and keep it from entering the hay too far. The pole is held in an erect position by guy ropes attached to a plate



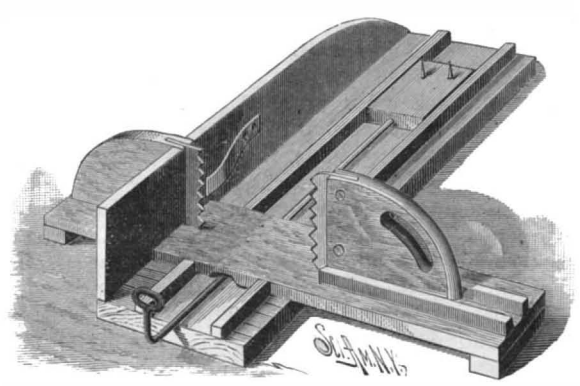
SOSEMAN'S HAY STACKER.

pivoted to its upper end. The derrick arm is made in two parts hinged to each other at the upper edges of their adjacent ends, so that the outer part of the arm is free to swing upward, but cannot swing downward below a horizontal position. This derrick arm is held to the pole by a frame provided with suitable rollers, as shown in the engraving, and may be raised up or down, or swung around the pole. The hoisting rope passes from the place where the power is applied over a pulley hung in the small pivoted frame at the top of the mast, then over a pulley pivoted in bearings attached to the opposite sides of and projecting beyond the outer end of the derrick arm. The end of the rope is fastened to an ordinary hay fork, to raise the hay or straw to be packed. Attached to the rope a little distance from the fork is a ball, which, when the loaded fork has been raised to the required height, passes over the arm pulley and comes in contact with the lower side of the forward ends of two bars, by which the rope is prevented from passing any further over the pulley, and is made to raise the forward part of the arm (as shown by the dotted lines) into a vertical position, bringing the fork nearer the center of the stack and allowing the load to be deposited at any desired place by swinging the arm around the pole. While being swung around, the arm is held in the forked outer end of a horizontal arm attached to the top of the supporting frame. The hoisting rope is also prevented from swinging about by a properly arranged forked bar. As the forward part of the derrick arm is raised, the bars at its outer end are made to clamp the rope, to prevent its being drawn further through and to allow that part of the arm to be drawn down into a horizontal position by pulling upon the trip rope. These bars are unclamped as the arm comes to a level position.

This invention has been patented by Messrs. L. & T. Soseman, whose address is P. O. box 397, South Bend, Ind.

ICE CUTTING MACHINE.

The table forming the body of the machine is provided with a central longitudinal slot, to which is loosely fitted a slide, provided with spurs and having a rod attached to it, extending through the slot and bent up at the end to form a handle, by which the slide is drawn forward. Fixed to the back of the table is a board, to guide and hold the block of ice.



ELLIOTT PAGE & LEWIS' ICE CUTTING MACHINE.

A slotted bar, secured to the table at right angles, supports at one end a block provided with a serrated steel cutter, as shown in the cut, and having at the opposite end a guide in which slides a head carrying a second cutter. The block of ice to be cut is placed upon the table and moved forward between the cutters, when the sliding head is reciprocated to bring its cutter into engagement with the ice, which at the same time is pushed against the stationary cutter This quickly separates the block. These machines can be made in different sizes, to adapt them for use in connection with different sized blocks of ice.

This invention has been patented by Messrs. R. S. Elliott, L. W. Page, and H. F. Lewis, of Shreveport, Louisiana.

Care of the Hands.

There are not nearly as many secrets in hand treatment as people imagine. A little ammonia or borax in the water you wash your hands with, and that water just lukewarm, will keep the skin clean and soft. A little oatmeal mixed with the water will whiten the hands. Many people use glycerine on their hands when they go to bed, wearing gloves to keep the bedding clean; but glycerine does not agree with every one. It makes some skins harsh and red. These people should rub their hands with dry oatmeal and wear gloves in bed. The best preparation for the hands at night is white of egg with a grain of alum dissolved in it. Quacks have a fancy name for it; but all can make it and spread it over their hands, and the job is done. They also make the Roman toilet paste. It is merely white of egg, barley flour, and honey. They say it was used by the Romans in olden time. Any way, it is a first-rate thing; but it is a sticky sort of stuff to use, and does not do the work any better than oatmeal. The roughest and hardest hands can be made soft and white in a month's time by doctoring them a little at bed time, and all the tools you need are a nail brush, a bottle of ammonia, a box of powdered borax, and a little fine white sand to rub the stains off, or a cut of lemon, which will do even better, for the acid of the lemon will clean anything.

PLUMBER'S FURNACE.

This simple furnace, the invention of Mr. John Clegg, of 119 Richmond Street, Providence, R. I., produces a powerful draught in a very short time. The cast iron pot or bowl is secured on top of a metal frame fastened on a base. Into an aperture in the bottom of the pot projects the neck of a blower casing. Suitably mounted cogwheels and pinions, operated by a crank handle, revolve the fan in the blower very rapidly. The powerful current of air thus produced

CLEGG'S PLUMBER'S FURNACE.

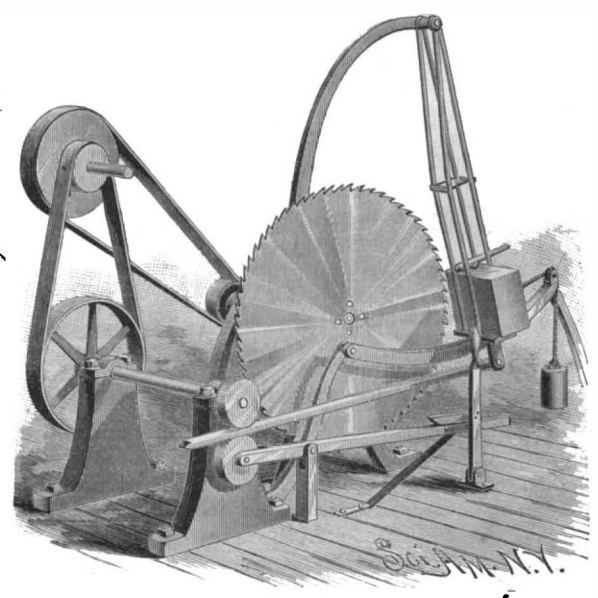
is directly delivered on the charcoal in the pot. As a high degree of heat is produced in a short time, the metal in the melting pot is melted in a few minutes. The furnace can be easily carried from place to place by means of the bail.

To Clean the Hands.

Petroleum jelly serves to clean and take away all traces of dirt from the hands after work in the shop or laboratory. For that purpose, you need only rub the hands with a small amount of the jelly, which, penetrating into the pores of the skin, incorporates itself with the greasy matters which are there. Wash them with warm water and Castile soap, and the hands become cleansed and softened.

FEED MECHANISM FOR SHINGLE MACHINES.

The shingle machine is of the ordinary kind, having a saw revolving in a vertical plane and a swinging block-carrying frame moving above a concave bed piece, and carrying the block, which is swung past the saw in the operation of removing a shingle from the block. The swinging frame is returned to the starting position by a weight attached to a rope passing over a pulley on the outer end of the curved bed, and secured to the swinging frame. To a short arm, projecting from the bottom of the swinging frame, is pivoted the end of a bar that passes between two rollers, one mounted on a shaft receiving its motion directly from the mandrel or through a countershaft as shown, and the other mounted in the end of a lever pivoted in the top of a standard in front of the saw. The other end of this lever can be depressed to cause the rollers to gripe the



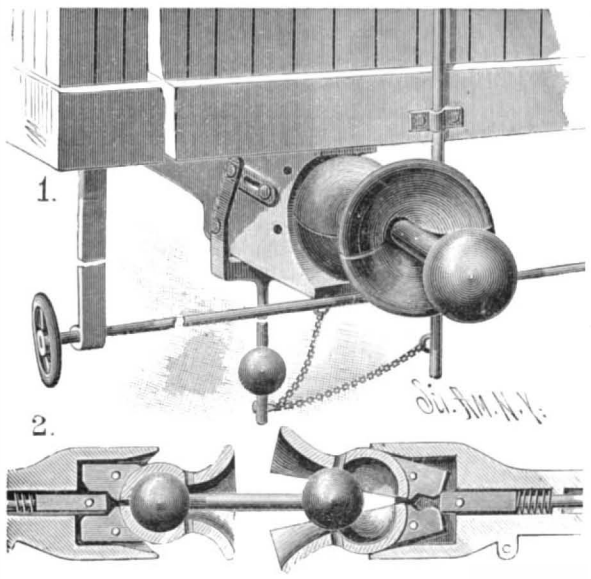
PURVES' FEED MECHANISM FOR SHINGLE MACHINES.

bar, and feed the block to the saw by means of a vertical hand lever pivoted to the floor. The pressure exerted, of course, controls the force of the grip of the rollers and the speed of feeding. The outer end of the lever is pressed upward and the rollers separated by a spring secured to the floor. If desired, the lever can be so arranged as to be operated by the foot.

This invention has been patented by Mr. W. L. Purves, of Waddington, N. Y.

CAR COUPLING.

The recess in the enlarged head of the drawbar is rectangular at its inner end, but is formed with beveled sides as it approaches the mouth of the head. Within this recess there are pivoted two coupling jaws, each formed with a hemispherical recess and a flaring mouth piece formed like one-half of an ordinary bell; between these parts there is a shoulder, as shown in the sectional view. Each jaw is provided with a rear lug formed with a notch, so that when the two jaws are in the



CHAPPELL'S CAR COUPLING.

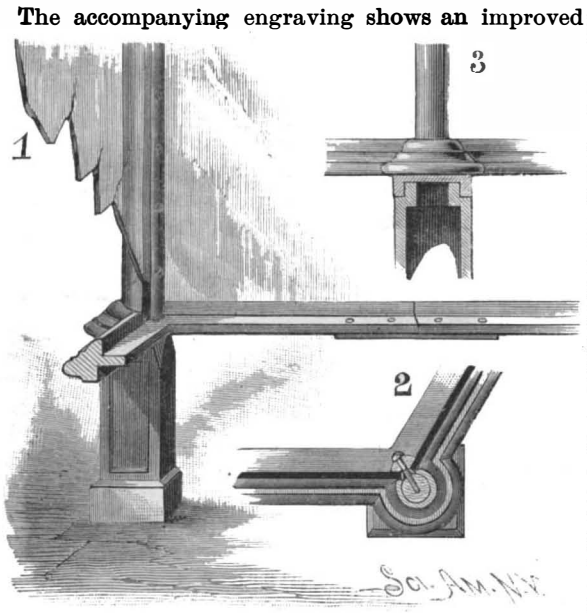
position shown at the left in Fig. 2, there will be a space between the lugs which can be entered by the locking dog, which is held forward and within the recess by a spiral spring. The dog is provided with a cross bar extending through slots in the sides of the drawhead. Links connect the ends of this cross bar with the ends of a U-shaped lever pivoted to a lug upon the under side of the drawhead. A downwardly extending arm of the lever is provided with a weight and is connected by chains which can be wound upon either a horizontal rod extending across the end of the car, or a vertical rod extending to the roof of the car; upon the outer ends of these rods are hand wheels by which the coupling can be operated without going between the cars. Upon each end of the coupling link there is a ball that fits snugly within the spherical recess.

The operation of this coupling is as follows: One end of the link is placed within the recess of one of the couplers, and the locking dog advanced between the lugs to hold the jaws closed. As the cars approach, the outer ball of the link strikes the bell-shaped mouth of the lower jaw of the other coupler, slides up the mouth piece, separates the jaws, and enters the spherical recess; the upper jaw drops to a horizontal position, and the lower jaw is raised by the ball striking the inner face of the recess, when the spring forces the dog between the lugs to lock the jaws. Each jaw is formed with an aperture through which a pin can be passed when it is necessary to use a coupling link of the ordinary construction.

This invention has been patented by Mr. Clifton T. Chappell, of 227 Second Street, Macon, Ga.

IMPROVED WINDOW SASH.

The accompanying engraving shows an improved



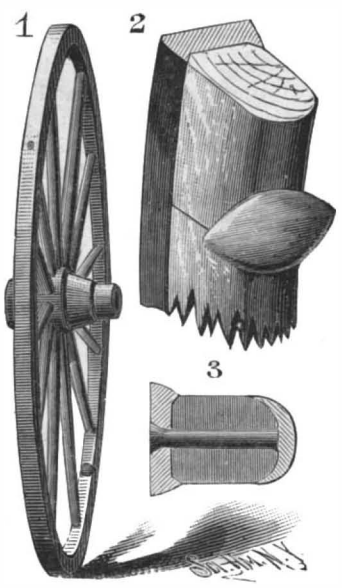
BROSNAN'S IMPROVED WINDOW SASH.

construction of the frames and sashes for store windows. The vertical post sustaining the edge or edges of the glass is formed of a pipe provided with a longitudinal slot at its inner side. This post is filled with wood, and the edges of the glass are held by a fillet secured against the margins of the glass by screws, as shown in the sectional plan view, Fig. 2. The lower end of the post rests in a socket formed in the upper end of a metal standard. In the case here shown, this socket is formed by the continuation of the fillet that extends along the top surface of the metal sash bar, and forms, with the horizontal inwardly projecting flange of the bar, the rabbet in which the lower edge of the glass is held. This flange also forms the support for the boards composing the flooring of the window. In the case of a window having a single post at the meeting edges of the glass, the sash bars are extended in both directions and their free ends are supported in the walls or columns of the building. In a window having two or more posts the adjacent ends of the sash bars are bolted to a connecting plate, as shown at the right in Fig. 1. By making the bars and support for the post in one piece, the relative movement of the parts is prevented. The standard may be made in two parts, as shown in Fig. 3. By using a metal frame for supporting the glass, there is no liability of the shrinking, warping, or giving away by decay, so as to allow the glass to settle, as is liable to occur in the construction of these parts commonly used. The metal sash bar, by occupying only a small part of the opening beneath the window, gives a much larger space for lighting the lower room than could heretofore be obtained.

This invention has been patented by Mr. P. J. Brosnan, of 200 Milwaukee Avenue, Chicago, Ill.

SIMPLE MEANS OF FASTENING WAGON TIRES.

The illustration herewith represents a means of securely fastening the tires of wagon and carriage wheels, so that it is almost impossible for them to spring from their position, while only two bolts are used, those being at the joints where the fellies come together. Fig. 2 is an enlarged and Fig. 3 a sectional view of the bolt and tire, showing how the joint is made. The tire is made with flanges to fit over the outside edges of the felly, so that it requires a full heat in being put on to give the necessary expansion, but the subsequent contraction is then sufficient to hold the felly firmly within



HITT'S TIRE AND TIRE BOLT.

the flanges of the tire. The bolt is then driven through the felly and tire, and riveted in a countersunk hole in the face of the latter, the head of the bolt being drawn over the felly on the inside, as shown in Fig. 3. The whole operation can be completed in far less time than it takes to put on a tire of the ordinary style, and the wheel has a neat and substantial finish. In this tire, also, the face is wider than the felly, and thus protects that and the spokes from injury from rock and dirt, while the flanges likewise help to stiffen the tire and help it to better keep its shape with hard usage.

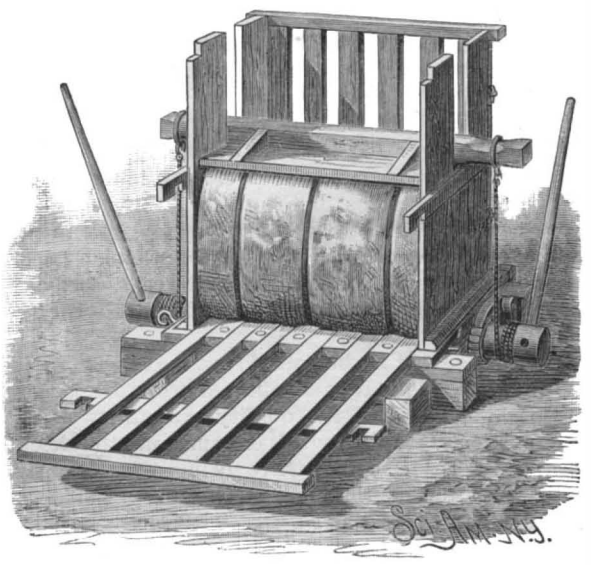
This invention has been patented by Mr. Lewis L. Hitt, No. 924 Market Street, Chattanooga, Tenn.

Test for Leather Belts.

Herr Eitner proposes the following method for testing the efficiency of belts: A small strip is cut off and placed in a jar filled with common vinegar. If the belt was well tanned and good quality, it may remain in the vinegar many months without being injuriously affected, it growing only a little darker in color. If, on the contrary, the belt was of an inferior make, its fibers begin soon to swell, and after a short time are transformed into a gelatinous mass.

HAY AND COTTON PRESS.

This press for baling hay and cotton is constructed in independent detachable sections, so as to be quickly set up for use and taken apart and compactly packed for storage or shipment. Upon the base are mounted the four sides composing the box. Two sides are made up of upright strips, between the spaces at the lower ends of which are the ends of similar strips forming the bottom. The upright strips are united by top and middle rails. The lower parts of the ends, each of which is made in one piece, are held from spreading by strips secured to the base. The upper ends of the four side pieces are held together by cross bars, which are halved into the extended ends of the middle rails. The lower ends of the two sides are pivoted to the frame by removable rods, which form hinges upon which either side can be turned down to form a platform upon which to receive the bale from the press. The follower is provided with a central cross beam extending through vertical openings in the ends; to the extended ends are secured ropes wound around a windlass turning in bearings in the base, by which the follower is drawn down to compress the bale. The windlass is



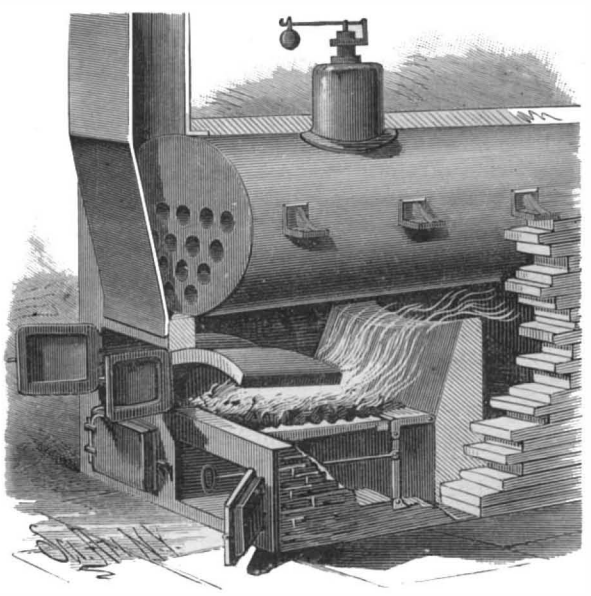
HANSEN'S HAY AND COTTON PRESS.

operated by a lever, and is prevented from turning backward by a pawl. That side of the box not to be used as a door may be connected to the ends by bolts and staples. To prevent the end pieces from rising off the base, they are notched beneath the top side rails.

This invention has been patented by Mr. H. G. Hansen, and further particulars can be had from Mr. Fred. Mackensie, of Calumet, Mich.

A SMOKE CONSUMING FURNACE.

The simple construction herewith illustrated, for promoting a more perfect combustion, and making a furnace which is in reality a smoke consumer, adapted for locomotive, marine, and stationary boilers, will be understood at a glance. Its most essential feature is in the arch located in the front of the combustion chamber, between the fire on the grate and the boiler, and dividing the combustion chamber so as to form a coking oven in its front half. Here the fuel is first fed, and after being there coked is forced back upon the rear of the stationary grate, where the process of combustion is completed. The arch is inclined toward the rear, so as to narrow the throat between the coking oven and the rest of the combustion chamber, so confining all the volatile products of combustion as to insure their most thorough utilization, that no smoke or soot may pass the bridge wall. The arch also prevents cold air from coming in contact with the boiler when the door is opened for the admission of fuel or otherwise. There is a dumping grate in the rear of the stationary grate, just in front of the bridge wall, which is provided with an operating bar, shown at the side of the ashpit door; as the clinkers are crowded to the rear end of the furnace in the



THE BACKUS BOILER FURNACE.

regular order of firing, they may thus be readily removed without disturbing the operation of the furnace or impairing its even and perfect combustion of fuel.

This invention has been patented in the United States and in several foreign countries by Mr. Absalom Backus, Jr., and these furnaces are manufactured by The Backus Company, of 505 Fort Street West, Detroit, Mich.

Shellac.*

BY J. BOSISTO, EXAMINER IN MATERIA MEDICA AT THE VICTORIA COLLEGE OF PHARMACY.

In the central provinces of India, especially in the thick jungles, the Coccus lacca insects may be seen dwelling together in thick set groups on the branches and twigs of *Zizyphus jujuba*, *Ficus religiosa*, *Butea frondosa*, besides other trees and shrubs belonging chiefly to the Leguminoseæ order. Each insect incrusts itself over with a resinous substance, forming within a cell containing larvæ and a deep coloring matter, the dead body of the parent being itself the cell. Hundreds of these are piled together, adhering to a twig, and in this condition it is termed stick lac, and contains about 70 per cent of resin, 10 per cent of coloring matter, and the rest debris.

The collecting of stick lac and the making of shellac, button lac, sheet lac, and lac dye, is an industry carried on by the Hindoos in the districts of the central provinces. In order to obtain the largest quantity both of resin and coloring matter, the stick lac is collected before the larvæ emerge from the cells, else, with their flight, they carry away the greater part of the dye coloring.

Since the advent of the anilin dyes, lac dye is but little in demand. The larvæ are allowed to mature, as they do not interfere with the quality or quantity of the resin portion. It is chiefly this circumstance that keeps down the price of shellac, there being, consequently, more insect workers than formerly.

The process of dealing with stick lac for the making of shellac and lac dye was witnessed by the writer when in India, and is as follows: The first part of the process is to separate the lac from the twigs. This is done by two women—one turning and the other feeding a primitive-shaped wooden mill. When a heap is formed (about a bushel in quantity), it is winnowed in a rustic-looking winnower, the lighter debris separating; the remainder is then hand picked. The process of grinding and winnowing is repeated until the whole is reduced to small, orange colored nodules. When in this condition, it is termed seed lac; the bright, garnet-colored pieces, being few in number, are now picked out and set aside for native ornaments. The seed lac is then placed in a large earthenware pan, and with it some water. A woman steps into the pan, steadying herself against the mud wall with her hands, then turning violently to the right and left, in order to keep the lac in a continual state of motion against her feet and the sides of the pan for some time, the other woman occasionally adding more water, until the vessel is full of a dark colored liquid. After settlement, the dye water is removed into another earthenware pan, and the lac again washed until the water runs away clear.

Lac Dye.—The treatment of the colored water for the purpose of obtaining from it the lac dye is very simple. After straining, lime water is added, which precipitates the dye. The water is then drawn off, and the dye drained through cotton cloth; from this it is transferred to compressible frames, containing strong iron plates, and reduced by a native screw press to solid sheets of dark purple dye about a quarter of an inch thick; these are cut up into cakes and stored till dry enough for packing, and then forwarded to Calcutta for sale in the bazars. The utilitarian value of lac dye over cochineal in a humid climate, especially in dyeing the scarlet cloth of the soldiers' coats, lies in its power to resist the action of human perspiration.

Shellac.—The manufacture of shellac is an entirely distinct process. The seed lac at the bottom of the pan is removed, dried, and sifted. The finer dust, which is highiy inflammable, is removed. The lac workers of India make it up into bracelets and ornaments of various kinds.

The coarse lac which is to be made into shell is put into long sausage-shaped bags of about two inches diameter, made of cloth like American drill. Under a shed is a charcoal fire about two feet long and six inches wide; alongside of the fireplace is a bamboo pole, about three feet long and four inches in diameter, filled with warm sand, inclining at a slight angle to the ground. On each side of the fireplace is sitting a man, or more generally a woman, each holding an end of the sausage-roll-looking bag about twelve inches high over the clear charcoal fire, turning the roll or bag briskly until the lac begins to ooze through the interstices of the cloth; the bag is still kept twisted until a coating of soft lac covers the outside. It is then removed from the fire, and a small disk of lac is placed here and there over the surface of the bamboo by a rapid turn of the wrist. A third woman is sitting at one end of the bamboo, holding in both hands a strip of aloe leaf, resembling very much a thin magic wand; this she pushes forward over the soft lac, repeating the motion three or four times, when a thin film of the lac covers over the round surface of the bamboo, which is immediately transferred into an open basket. The lac drying rapidly cracks up into many pieces; this is shellac.

Button lac is simply shellac without spreading.

Sheet lac is made in a similar manner to shellac, only the sheets are much thicker, and the woman removing it from the bamboo in a supple condition and with both hands stretches it over the fire in order to remove the wave-like furrows which are impressed on it by the fibrous surface of the aloe leaf. While doing this, it is not uncommon to see the woman—who performs her work intelligently—lift the hot sheet to her mouth and bite out any foreign substance, such as dirt or sand, filling in the hole so made by a rapid movement of her hand over the sheet. The average rate of wages is an anna and a quarter (1⅞ of a penny) per day.

* *Australasian Journal of Pharmacy.*

Report by M. Pasteur.

At the last meeting of the Academy of Sciences, Paris, M. Pasteur read the following report of the results of his antirabic treatment at his laboratory in the Rue d'Ulm: "The number of persons so treated amounted, up to the 12th April, to 726, including those who are still undergoing treatment. Of this number, there were 688 who were bitten by mad dogs and thirty-eight by wolves, the latter being all Russians. The patients belonging to the first category are, with the exception of the little girl Pelletier, who, it will be remembered, died after a few inoculations, all doing well. More than half of that number have passed the dangerous period. Of the thirty-eight Russians who have been treated and are still undergoing treatment, three have died rabic; the others are doing well, but it is impossible to foresee what may happen to them, as there exists a profound difference between the bites of dogs and those of wolves, the proportion of deaths caused by rabid wolves being at least 82 per cent." M. Pasteur then concluded his report in the following terms: "The above facts demonstrate (1) that the duration of incubation of human rabies caused by the bite of a rabid wolf is often very short, very much shorter than rabies after the bite of a mad dog; (2) that the mortality after the bites of rabid wolves is considerable, if we compare it with the effects from the bites of dogs. These two propositions may be sufficiently explained by the number, the depth, and the seat of the bites caused by the wolf, which so savagely attacks his victim, the attack being often on the head and face. The necropsy of the three Russians who died at the Hotel Dieu, and the inoculation of rabbits, guinea pigs, and dogs with the medulla oblongata of the first of the patients who died, prove that the virus of the wolf and that of the dog are sensibly of the same degree of virulence, and that the difference of the rabies of the wolf and that of the dog depends on the number and nature of the bites. These facts induced me to inquire whether, in the case of bites from rabid wolves, the method could not be usefully modified by inoculations in greater number and within a shorter time. The results will be eventually reported to the Academy. In any case, for the wolf in particular, it is good to submit the patient to the preventive treatment as soon as possible. The Russians of Smolensk were six days on their journey to Paris, and presented themselves at the laboratory fourteen or fifteen days after having been bitten. They might therefore have commenced the treatment eight days earlier, and one cannot say what might have been the influence of this modification for the three patients who have succumbed."

Swedish Iron Mountain.

It cannot be said that our iron mining companies have latterly had any very profitable times, for they have had to pay ruinous mineral royalties at a time when trade is very depressed and prices almost unprecedentedly low, and the amount of competition existing not only between home, but from Spanish, Swedish, and other foreign sources, is very great. It has become a common occurrence, in fact, for imported ores to undersell ours, even in places contiguous to the mines. An enterprise, however, is now being undertaken which, when completed, will have a considerable effect on the iron ore market of both this country and the Continent, and will lead to still further competition in this direction. We allude to the opening up of what are perhaps the largest deposits of iron ore to be found in the world, large hills being almost entirely composed of this material of an extremely rich and valuable nature. The deposits in question are situated in the extreme north of Sweden, verging on Lapland, and a railway is now being constructed for the purpose of bringing the metal to market. The Northern Europe railway, said to be the most northern in the world, commences at the port of Lulea, at the northwest end of the Gulf of Bothnia, a town of about 4,000 inhabitants, having a very large timber trade, and possessing a good harbor, which vessels of large tonnage can easily enter, and runs across the Scandinavian peninsula to Ofoton Fjord on the Atlantic coast of Norway. The line follows the Lulea River valley for the first twenty-five miles, then, turning north, crosses the Arctic Circle and proceeds to Gellivara, 140 miles from Lulea. This section of the line, in which the work of construction is light, passing principally through valleys of sand and gravel, is now on the point of completion.

Vast forest of pine are here met with, extending over hundreds of square miles, and timber will now be able to be readily brought to the port of shipment. At Gellivara stands the mountain of that name, entirely composed of rich iron ore, hundreds of feet thick, and covering many square miles. The ore requires no mining, being close to the surface, and can be quarried and put into railway wagons direct, the railway passing round the mountain for that purpose. A small portion of this ore already reaches Lulea, being carted the whole distance during the winter months. After leaving Gellivara, the line passes Lake Tjantjas and Panki, to the great iron mountain of Kirunavara, whose peak of solid metal is visible at a distance of forty miles. This mountain is several miles long and 850 feet above the level of Panki Lake. It is composed of about 98½ per cent of peroxide of iron, very rich in quality, and is estimated to contain about 280,000,000 tons of metal above the waters of the lake. It is estimated this ore can be quarried and put into trucks for two shillings per ton. It will have to be carried eighty-five miles by rail to the proposed Atlantic harbor. A sister iron mountain, Luosavara, stands four miles to the northwest of Kirunavara, being about the same height, and also containing gigantic deposits of equally rich ore. The two mountains are separated by a valley, through which the railway will pass on its way to the Norwegian frontier, running by the Great Torne Lake, fifty miles long, and through forests of fir trees, until the frontier is passed on a tableland 1,600 feet above the sea level. The descent from the Kjolen mountains to the terminus, a distance of 28 miles, is circuitous, and will necessitate some severe gradients and expensive works during construction, which is being undertaken by English contractors under the supervision of English engineers.—*Mechanical World.*

Using One's Eyes.

How many of us go through life without ever realizing that our eyes have to be educated to see as well as our tongues to speak, and that only the barest outlines of the complex and ever-changing images focused on the retina ordinarily impress themselves upon the brain? That the education of the eye may be brought to a high state of perfection is shown in numerous ways.

There are many delicate processes of manufacture which depend for their practical success upon the nice visual perception of the skilled artisan, who almost unconsciously detects variations of temperature, color, density, etc., of his materials which are inappreciable to the ordinary eye.

The hunter, the mariner, the artist, the scientist, each needs to educate the eye to quick action in his special field of research before he can hope to become expert in it.

The following story from the *Penn Monthly*, which is quite *apropos*, is related of Agassiz, and it is sufficiently characteristic of this remarkably accurate observer to have the merit of probability. We are told that once upon a time the Professor had occasion to select an assistant from one of his classes. There were a number of candidates for the post of honor, and finding himself in a quandary as to which one he should choose, the happy thought occurred to him of subjecting three of the more promising students in turn to the simple test of describing the view from his laboratory window, which overlooked the side yard of the college. One said that he saw merely a board fence and a brick pavement; another added a stream of soapy water; a third detected the color of the paint on the fence, noted a green mould or fungus on the bricks, and evidences of "bluing" in the water, besides other details. It is needless to tell to which candidate was awarded the coveted position.

Houdin, the celebrated prestidigitator, attributed his success in his profession mainly to his quickness of perception, which, he tells us in his entertaining autobiography, he acquired by educating his eye to detect a large number of objects at a single glance. His simple plan was to select a shop window full of a miscellaneous assortment of articles, and walk rapidly past it a number of times every day, writing down each object which impressed itself on his mind. In this way he was able, after a time, to detect instantaneously all of the articles in the window, even though they might be numbered by scores.

SPEAKING on the "Corrosion of Iron and Steel," Mr. T. H. Davis, F.I.C., formerly assistant at the Royal College of Chemistry and School of Mines, London, says if the air or water which surrounds iron contains carbonic acid or any free acid in minute quantity, the corrosion increases rapidly; but if a caustic alkali, such as potash, soda, or lime be present, the corrosion ceases altogether while any causticity remains, because oxygen and carbonic acid have greater affinities for these alkalies than for iron. He also points out that a perfect paint for the protection and preservation of iron and steel should be one which has a high mechanical adhesive property, and composed of such materials as are related electro-negatively to iron, mixed with some tenacious fluid vehicle containing little or no oxygen, and not capable of being decomposed by the iron beneath it. This would exclude most oily paints.

Correspondence.

Mining Precautions.

To the Editor of the Scientific American:

Let mining companies be compelled by law to put down bore holes, from the surface of the ground, at greater or less intervals over the entire course of the mine. The holes would not be very expensive to put down, and could be sunk with any prospecting well or oil rig. They should be large enough to contain a tube two or three inches in diameter, with good valves at each end. It seems to me that this plan would do away with part of the risk that miners undergo from being imprisoned by a cave-in.

The holes could also be used for aiding the regular ventilating of the mine. IRVING BOARDMAN.

Elmira, N. Y., February 8, 1886.

Collisions at Sea.

To the Editor of the Scientific American:

Having long been an attentive reader of your valuable journal, I have followed with unusual interest the suggestions offered from time to time by Mr. E. Reynolds in nautical matters. His last appears in the SCIENTIFIC AMERICAN of April 17; and as I have spent the best part of thirteen years at sea, in merchant sailing vessels as well as in steamers and men of war of six different nations, I hope that I will be able to contribute my mite toward lessening the greatest of all perils at sea. Mr. Reynolds is perfectly right in asserting that the greatest danger lies in the uncertainty of which most masters of sailing vessels become possessed on the approach of a steamer. How often have I heard the command from my captain, I having the wheel at the time: "Keep her off a little," "Keep her off another point," though we in our sailing craft had the right of way beyond dispute. Rapid communication at night at a safe distance between the approaching vessels is therefore the goal to be attained. Let me propose the following:

In the United States Navy they are using with great success "Very's signal lights" for night signaling; the apparatus consisting in a pair of brass pistols and a sufficient number of cartridges in green and red, which are fired from the pistols, ascending from 60 to 100 yards into the air and giving a brilliant light, red or green, during ascent and descent. Time of light, 60 to 80 seconds; cost of the whole apparatus, probably $20. Now, let every sea-going vessel be provided with this apparatus, and establish, through the same means by which "the rules of the road at sea" were made international, the following three simple rules:

1. One red light fired means: "I am going to keep my course."

2. One green light fired means: "I am going to starboard my helm."

3. Two red lights fired simultaneously, the lights ascending from the bow of the vessel at an angle of from 15 to 30 degrees, means: "I am going to port my helm."

As the lights which I have seen fired during a four years' cruise in Chinese waters always ascended much higher than the headlight of a steamer is usually fixed above the water line, and as those headlights are supposed to be visible at a distance of five nautical miles, it is safe to presume that communication at night between approaching vessels may be commenced at a distance of five miles. A more perfect code of night signals may be easily constructed from the combination of these red and green lights; but I think, for the purpose of letting the other vessel know distinctly what one intends doing, the above three rules would be sufficient. I have seen these lights fired in all conditions and in all kinds of weather at sea, and they stood the test very well; and as the outlay for the apparatus is not worth mentioning in comparison with the lives and millions' worth of property yearly lost through the inability to communicate during night time at sea, the above plan may be well worth considering. HUGO L. R. LEHMANN.

Fort Lewis, Colo., Company B, 22d U. S. Infantry.

A Mile of Coal Cars.

A correspondent wants to know how much coal there may be in a mile of loaded coal cars. In reply we can say that a 5 ton car or coal jimmy is 11 ft. 6 in. in length from bumper to bumper. An 11 ton car is 22 ft. 1 in. A car holding from 14 to 16 tons of anthracite is 24 ft. 2 in. A gondola of 20 tons capacity is put at 27 ft. 4 in. A large gondola with 25 tons capacity is 32 ft. in length. Now, then, for the quantity. There will be 460 of the jimmies to the mile, and that means 2,300 tons of coal, perhaps. There will be 240 of the double jimmies, and that means perhaps 2,640 tons. There will be 218 of the large cars, and that may mean 3,270 tons. Of the gondolas there will be 193 cars, and this may mean 3,840 tons. Then of the larger ones there are, say, 160 cars, which will equal in capacity 4,000 tons. All this goes to show that when you see or hear of a mile or two of cars standing loaded, it really does not mean so very much coal.—*Coal Trade Journal.*

The Force of a Blow.

An interesting discussion has been going on in our pages for some weeks concerning pile driving. For the benefit of our younger readers it may be well to explain what it is all about. It turns on a question often asked, namely, What is the force of a blow? It is a remarkable circumstance that this question seems to constitute a *pons asinorum* for a very large number of persons, although the solution of the problem presents no difficulties of any kind to those capable of understanding a few very simple physical laws. As, however, we know that the whole problem is a vexation of spirit to many students, and that even engineers of larger growth have quite failed to understand it, we propose here to give such an explanation of it as will, we hope, suffice to clear up all obscurities and render its solution perfectly easy.

To simplify matters, we shall assume that the blow with which we have to deal is caused by gravity; that, in a word, it is due to the arrest of a falling weight, such, for example, as the monkey of a pile driver; but our readers will, we think, have no difficulty in understanding that a blow is a blow, no matter how dealt—whether it be delivered on a target by a shot projected from a 100 ton gun or with a tiny hammer on the head of a tin tack. In their nature both blows are the same; they only differ in degree. A falling body cannot do more work when its progress is arrested than has been done on it in lifting it up to the height from which it has fallen. Thus, for example, let us suppose that the monkey of a pile engine weighs one ton, and that it falls 4 feet on to the head of a pile; then the work in the monkey cannot be either more or less than equivalent to four foot tons. A foot ton is simply an arbitrary unit. The proposition may be expressed in various ways. Thus, the work in the monkey at the moment it touched the head of the pile would be sufficient to raise the monkey up again to the point from which it fell; or to raise a weight of 4 tons a height of 1 foot; or to raise 1 pound through a height of $2,240 \times 4 = 8,960$ feet; or to raise a weight of 48 tons through a height of 1 inch, and so on. It is essential that this little matter of equivalence be clearly understood. To drive it home still further, we may say that a horse power is equivalent to lifting a weight of 33,000 pounds through a height of 1 foot in a minute. But the result would be the same if 1 pound was raised 33,000 feet in a minute. We may, in short, go on ringing the changes how we please between weight and height. The result will invariably be the same, one element in the calculation being always diminished as the other is increased. Now, it is clear that if our monkey were employed to raise 1 ton through a height of four feet, it must exert a force or push of 1 ton throughout the distance 4 feet. If it did not, it would not move one ton at all, for it would be overbalanced. If it were called upon to raise 4 tons through a height of 1 foot, then it must exert a push of 4 tons through a distance of 1 foot; if to lift a weight of 48 tons, then it must exert a push of 48 tons through a distance of 1 inch, and so on. Bearing this in mind, there will be no difficuty in understanding the following simple rule: *The force of a blow is measured by dividing the whole distance x passed through by the monkey before impact by the distance y passed through after impact, and multiplying the weight by the quotient.* Thus, let the monkey weigh 1 ton, let the fall x be 48 inches, let the pile descend 1 inch$=y$ at each blow, then the force of the blow—or, in other words, the push or effort exerted by the monkey on the top of the pile—will be $\frac{48}{1}=48$, and $48 \times 1 = 48$ tons. If the fall was 20 feet, or 240 inches, then the effort would be 240 tons, and so on. It must be understood that this is the mean or average force of the blow. Its initial effort may be much greater and its terminal effort may be much less, because at the instant of impact the monkey is moving at its full velocity, while at the moment when the pile ceases to descend it will have no motion at all, and consequently will exert no push, except that due to its weight. With this aspect of the question, however, the student need not now concern himself. It will be seen that the force can be varied by altering either the distance passed through before or after impact. For example, the monkey weighing 1 ton and falling 48 inches, let the pile descend only $\frac{1}{8}$ inch, then $48 \times 8 \times 1 = 384$ tons; and this leads to an important deduction. If y becomes infinitely small, the force of impact will become infinitely great. We are led thus to the ancient problem, If an irresistible force encounters an insurmountable obstacle, what will happen? No such condition can by any possibility occur in practice. Some movement must take place after impact.

If our readers have followed what we have said, they will see that to ask how to calculate the force of blow, giving only the weight and the fall, is to put an absurd question. Three factors are in all cases necessary, namely, the weight, the height of fall, and the distance through which the body which receives the blow moves. In practice it is by no means easy to ascertain the latter with precision; and the energy in the falling body can be expended in more ways than one. For example, when the head of a pile is struck, two effects take place simultaneously—the monkey is shortened and so is the pile. The elastic rebound of each immediately takes place, and the monkey jumps up from the top of the pile. Again, the top of the pile becomes highly heated. In very dry weather the top of a pile has been known to take fire under the blows of a light monkey rapidly repeated. The elasticity of the pile plays an important part in influencing the rate of its descent. A monkey weighing 100 pounds, falling a height of 50 feet, will have stored in it on impact $50 \times 100 = 5,000$ foot pounds, and if the progress of the pile were 1 inch, its driving force would be $600 \times 100 = 60,000$ pounds. A monkey weighing 1,000 pounds, and falling 5 feet, would also have 5,000 foot pounds of work in it, and would exert a driving force of 60,000 pounds over a space of 1 inch; but it does not follow that the former would be equally effective in driving the pile. On the contrary, the lighter monkey striking the pile with a higher velocity might be much the less efficient of the two, because the force of the blow would not be transmitted through the pile, but would be expended in compressing the top of it, probably in shattering the wood. We do not propose to go here into any questions concerning modulus of elasticity, which would only serve to complicate a statement which we desire to keep so simple that it may be understood by those who only possess the most elementary mathematical knowledge; but this article would, on the other hand, be manifestly incomplete if we did not say something further concerning the respective values of light and heavy monkeys and hammers and high and low falls.

When a pile is struck on the top, what is known as a wave of compression passes through it; and this wave requires time for its passage. Such a wave is set up in all columns when stress is suddenly brought on one end. Thus, for example, if the muzzle of a fowling piece containing a column of air is plugged up with a cork, or with snow or mud, the barrel may be burst when the weapon is fired, simply because, while the pressure at the muzzle is yet too small to move the cork, the pressure at the breech end is great enough to burst the barrel. The wave of compression will not reach the muzzle till the breech has been burst. In the same way the detonation of a lump of dynamite on a rail will break it, the action being so sudden that the wave of transmission of pressure has not time to pass through the air surrounding the dynamite, and the air really plays almost the same part as a block of steel round the explosive. The effect of a heavy ram falling a short distance on a pile head resembles a push, in a sense, and gives time for the transmission of the effort throughout the whole pile; but when a light monkey falls, the effect may be confined to the top of the pile, which is shattered. In order to make this quite clear, we must take into account the element time, concerning which we have said nothing yet.

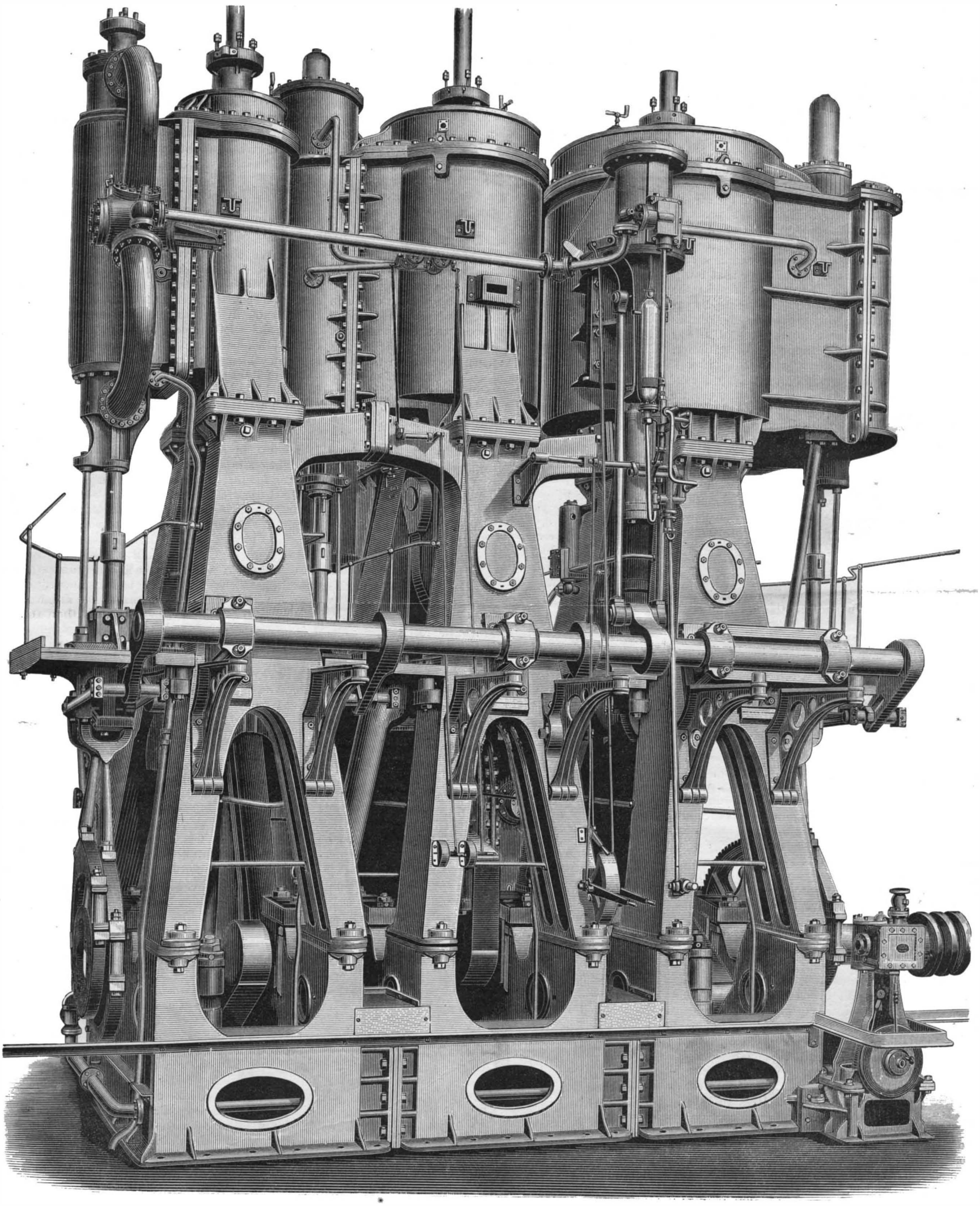
The velocity with which a monkey strikes a ram is calculated by extracting the square root of the height of fall in feet and multiplying it by 8. Thus, let the monkey fall 4 feet; the square root of 4 is 2, and $2 \times 8 = 16$ feet per second. If the monkey fall, as stated in our last example, 50 feet, then we have 7 as the nearest whole number square root, and $7 \times 8 = 56$ feet per second as the velocity with which the monkey would strike the pile. If this speed was greater than that at which the wave of transmission could pass through the pile, then little or no effect would be produced in the way of causing its descent; nearly the whole of the work would be done in compressing the top of the pile or in shattering it, and the driving effect would be *nil.* This, it will be seen, is the aspect of the question now being discussed by Mr. Donaldson and "Scrutator," and there is plenty of room for discussion, because very little seems to be really known concerning a great many practical points connected with pile driving. The efficiency of the pile driver is affected by the length, weight, and material of the pile, the condition of its head, and the character of the ground in which it is being driven. The effect of the element time is not sufficiently well understood. About, indeed, the only thing fully recognized is that a heavy monkey falling from a moderate height is, other things being equal, much more efficient than a light monkey falling from a great height.—*The Engineer.*

Thunderstorm in a Clear Sky.

Capt. Anderson, of the British bark Siddartha, which lately arrived in New York, reported a peculiar thunderstorm on April 27, while on the northern edge of the Gulf Stream. The sky was quite clear at the time and the sun shining brightly, although there appeared to be a thin mist about the ship. Suddenly there appeared a vivid flash of lightning, accompanied by violent thunder. The compass was caused to vibrate perceptibly for a period of 15 minutes.

TRIPLE EXPANSION ENGINES.

We illustrate a very excellent example of expansion engines, designed by Mr. Kirk, of the firm of R. Napier & Sons, Glasgow. These engines were built for the steamer Aberdeen, one of those large vessels belonging to Geo. Thompson & Co., designed for long voyages, such as the line between England and Australia. For such voyages, the fuel economy is of the greatest importance.



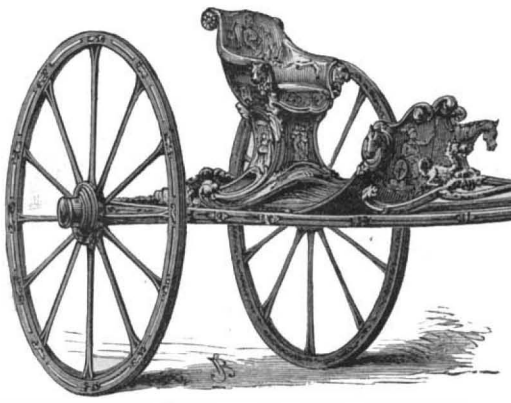
TRIPLE EXPANSION ENGINES.

The Aberdeen is a ship built of iron, both ship and engines being of the highest class at Lloyd's, 350 feet long by 44 feet by 33 feet. When the ship was complete, 2,000 tons of dead weight were put on board, and arrangements were made to test the consumption on a six hours' run at 1,800 horse power; this, however, by the owner's desire, was reduced to four only. The coal was Penrikyber Welsh coal, and Messrs. Parker & Dunlop, who happened to be on board, kindly undertook to examine the state of the fires, and see the coal weighed. The result was a consumption of 1·28 lb. per indicated horse power. The next trial was to find the maximum speed, which on four runs on the measured mile, occupying two hours, was 13·74 knots, the mean power being 2,631, and the consumption of coal during these two hours being 1 ton 17 cwt. per hour. The weight of steam condensed in the jackets, carefully measured into a tank, was 3¾ degrees per cent of the greatest weight of steam admitted to the high pressure cylinder, by diagram, the pressure on the jacket of the middle cylinder being 30 lb., and on the low pressure cylinder 10 lb. In a second experiment the condensed water was still the same percentage when the pressure in each jacket was doubled. The loss of steam from the high pressure cylinder to the low pressure, just before release, plus the steam condensed in the jackets, was the same as took place inside the cylinders with the steam shut off from the jackets.

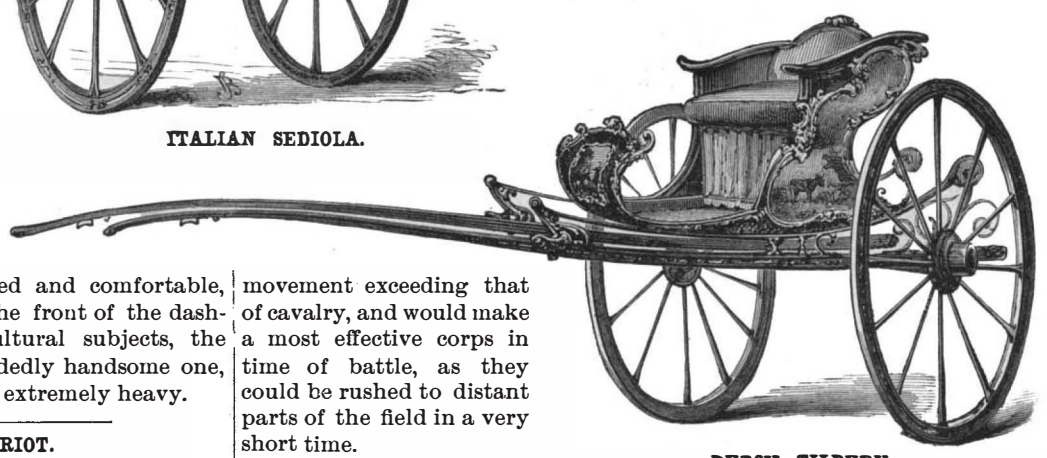
The cylinders of the Aberdeen are 30 in., 45 in., and 70 in. by 4 ft. 6 in. stroke. The boilers, two in number, are ordinary double-ended boilers, constructed entirely of steel, with six of Fox's corrugated furnaces in each, the total heating surface being 7,128 square feet. There is no superheater. The construction of these boilers for so high a pressure—125 lb. per square inch—was facilitated by their being built of steel and to Lloyd's, whose rules allow the shells to be made thinner than required by the Board of Trade, although the internal parts are as strong as those required by the latter. After all, the shell is the simplest and strongest part of a round boiler, where, even if built to Lloyd's, there is superabundance of strength; but to doubly insure success—the internal parts of a boiler being those which oftenest give trouble—they were made stronger than required by either Lloyd's or the Board of Trade, whose scantlings for these parts are practically the same. The high pressure cylinder was not jacketed, the second was jacketed with steam of 50 lb. pressure, and the low pressure one with steam of 15 lb. above the atmosphere. We are indebted to the *Engineer* for our engraving and these particulars.

CARRIAGE MAKERS' WORK IN THE LAST CENTURY.

It was not until the latter part of the seventeenth and the commencement of the eighteenth century that the inventor and mechanician seem to have applied themselves to making carriages which could be used with sufficient comfort to attain any degree of popularity. The most of the specimens we have of the work of an earlier period must have been extremely clumsy and awkward for actual service, though some of them are richly carved and elaborately decorated. In the French museum of Cluny is a fine collection of eighteenth century carriages, two singular vehicles belonging to which are represented in the accompanying illustrations. It is said that a vehicle something like the sediola here shown is still used in some parts of Italy. It is fixed without any kind of suspension to the shafts, obtaining its spring from their great length, and is allied to the Norwegian carriole, the Neapolitan calesso, and the Cuban volante. The body is decorated with carvings of mythological subjects in bold relief, and the wheels are elaborately painted, animals and birds being profusely represented on the tire. The Dutch tilbury shown is built more after the style of our gigs at present, being suspended on straps which go over small wheels at the back, so they can be loosened or tightened at will. The seat is padded and comfortable, and the sides and back, with the front of the dashboard, are pictured with agricultural subjects, the vehicle being on the whole a decidedly handsome one, strongly built, but without being extremely heavy.



ITALIAN SEDIOLA.



DUTCH TILBURY.

A SCYTHIAN CHARIOT.

M. MEIGS, U. S. C. E.

I was much interested in the drawing published in a late number of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 528, describing an ancient Egyptian chariot wheel found in a recently opened tomb.

I send you a sketch of a chariot no less curious, which I find in my sketch book, and which I think had a somewhat similar origin. The vehicle represented in the sketch was taken from an Egyptian tomb of the date 1400 B.C.

It is said to be of Scythian origin, and probably formed part of the spoils of some Egyptian victory. Only a portion of the rawhide lashings with which all the joints were secured now remain. The hub is a composite affair, consisting of an inside tube made in two pieces, and afterward put together with wooden rings fitting over the ends of the tube.

The spokes, which are of wood with a natural crook, are made like the letter L, and are four in number, being fitted into a groove in the hub; the long arm of the L extending out to and into the felly, and the short arm bent at right angles and notched and fitted to the adjacent spoke. The whole was firmly bound together with rawhide.

The fellies, two in number, are scarfed together between the spokes and also lashed with rawhide. The section of the felly is oval or elliptical, and I could not discover that there was any provision made for protecting the wood with a tire of any sort. The floor of the chariot was of rawhide thongs, and must have made a very elastic footing indeed.

A light, elegantly curved yoke was attached to the pole of the vehicle by a pin and lashings, and was attached to the two horses by means of a forked piece of wood like an inverted Y, this piece being placed astride the neck in front of the withers and lashed to the yoke.

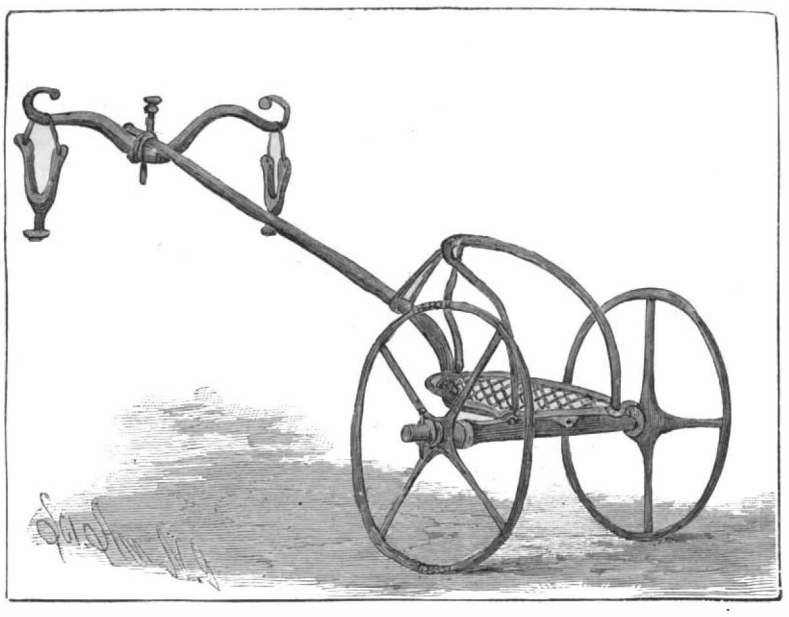
The weight of the whole vehicle, harness, yokes, etc., I estimated at not over 50 pounds, and the method of attaching to the horses must have left them with almost perfect liberty of motion.

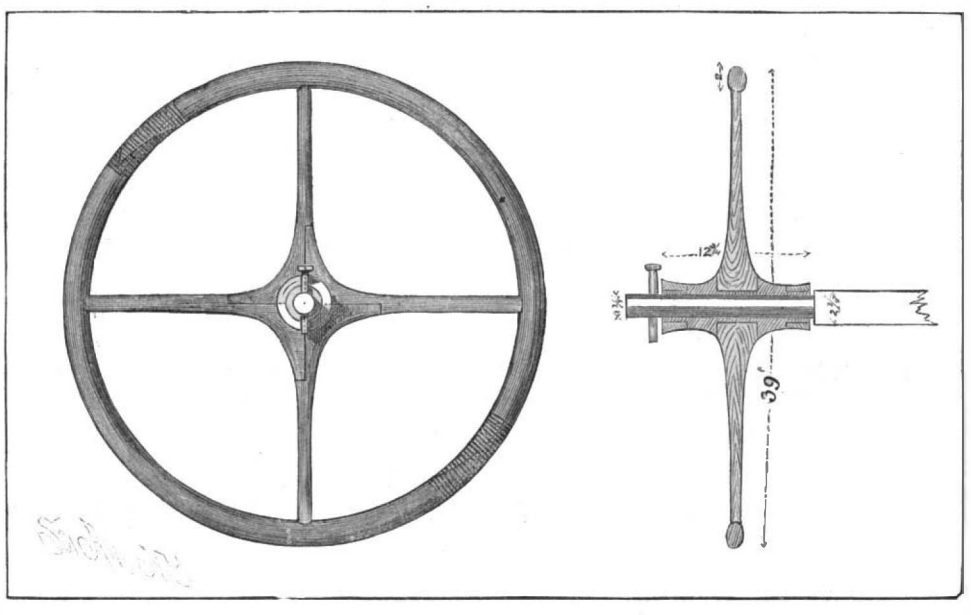
A squadron of such chariots, with two men (a driver and an archer) in each, must have been an exceedingly efficient sort of light artillery.

Perhaps we may witness in our own day, when cavalry has become only a sort of mounted infantry, a return to the methods of 3,000 years ago. There are great advantages in such a light cart as this chariot. It is too low to be upset, and can be taken over any sort of country. The harness and weight are reduced to a minimum. A regiment furnished with such chariots and with repeating rifles would have a rapidity of movement exceeding that of cavalry, and would make a most effective corps in time of battle, as they could be rushed to distant parts of the field in a very short time.

I append the following dimensions: Axle, 79 in. long; seat, 39 in. long, 20 in. deep; pole, 1½ in. diameter small end, 3 in. diameter large end; wheels, 39 in. diameter; hubs, 12¾ in. long; yoke, 35 in. long, outside to outside; neck fork or saddle, 10 in. long.

The chariot is now in the Etruscan Museum at Florence.





A SCYTHIAN CHARIOT.

Photography by a Lightning Flash.

BY PROF. EDWIN J. HOUSTON.

Mr. Albert S. Barker, of Philadelphia, has recently succeeded in taking two very fair photographic negatives of outside objects while illumined by no other light than that of a single lightning flash. These photographic views were taken at 7 P.M. on Thursday, October 29, 1885, near Philadelphia. The night was excessively dark, the wind strong, and the rain heavy. The camera was placed in an open window, with the slide drawn. The lightning flash came in less than one minute, when the slide was returned. The plate holder was then reversed and suitably placed for a second exposure. The plate was one of the highly sensitive gelatine films.

Mr. Barker developed the plates the same evening. From their behavior he rated the actinic effect of the light as equal to that obtained from an exposure of about $\frac{1}{800}$ part of a second in bright sunlight.

The popular impression as to the duration of the lightning flash is that it is practically instantaneous. From the experiments of Wheatstone and others with the rotating disk, the duration of the flashes measured would vary apparently from the $\frac{1}{1000}$ to the $\frac{1}{10000}$ of a second. Others estimate the duration of the flash as even shorter than these figures.

It is very doubtful if the average severe flash in this latitude does not endure or continue for a very much longer period. Despite the popular belief to the contrary, the author has frequently observed the motion of foliage when illumined by no other light than the lightning flash. This would not, of course, be the case if the flash were even approximately instantaneous.

It is a very significant fact that in the photographs of Mr. Barker the foliage shows unmistakable evidence of having perceptibly moved during the period of exposure; thus showing that it was by no means instantaneous.

It is to be hoped that Mr. Barker, or some other photographer, will repeat these exposures under the following conditions, viz.; to make the exposure while the camera is sharply focused on moving foliage or a rapidly rotating wheel, while illumined by a lightning flash, so as to determine more definitely the duration of the flash.

In the case of the lightning flash, the large percentage of blue rays would of course render the plate more sensitive to the extremely short exposure by practically prolonging the same, since the ordinary photographic chemicals now employed are especially sensitive to the blue portions of the spectrum.

It would appear from the facts developed by the photographs of Mr. Barker, that the method of measuring the duration of the lightning flash, as adopted by Wheatstone and others, which consists essentially in endeavoring to detect by the unassisted eye the change in position of a rapidly moving wheel or other object, while illumined by the flash, might be greatly improved by substituting for the eye the sensitive photographic plate, since the latter is apparently far more sensitive than the eye.

Should photographic pictures of a rapidly rotating wheel, whose rate of motion was known, be taken while illumined by a lightning flash, the displacement of the image on the negative would give far more reliable data for calculating the duration of the flash than the methods heretofore employed.

Mr. Barker's photographs, therefore, are not only interesting as showing how extremely sensitive the photographic plate may be made, but are also of interest as throwing some light on the possible duration of the lightning flash.—*Franklin Journal.*

Origin of Diastase.

Emile Laurent has investigated the question whether diastase is a product of bacterial action, or whether it can be formed without organic intervention. He placed seeds of lupin, maize, barley, and helianthus to germinate under a bell glass, over water which had been previously boiled, the seeds having been first freed from superficial micro-organisms by the ordinary processes of sterilization. When the sprout began to show, the seeds were introduced, with all necessary precautions, into tubes containing Koch's nutritive gelatine. The seeds continued to develop normally, without liquefying the gelatine, which constitutes, according to Koch, an infallible criterion of the absence of bacteria. Sprouted seeds, introduced into sterilized plum juice, continued to grow, without showing any bacteria in the liquid. Although these experiments can hardly be considered as decisive, they lend great probability to Laurent's opinion that bacterial intervention is not necessary.—*Bul. de l'Acad. Roy. de Belg.*, *No.* 7, 1885.

How to Intensify a Gelatine Negative for Line Work.

The *Brit. Jour. of Photo.* recommends the following: To prepare the negative for intensification, after thoroughly washing, soak it for five minutes in a bath composed of saturated solution of alum, to each pint of which an ounce of *aqua regia* has been added. Or, more conveniently, dissolve one ounce of common salt in four ounces of nitric acid by means of heat, and add to one pint of alum an ounce of the solution when cold.

In addition to clearing the film from stain, and preparing it for the silver intensifier, the above solution is useful in another way, namely, in clearing away any slight veil or fog. In this respect its action differs entirely from that of any other combination of alum and acid we have tried. If a veiled negative be treated with the alum solution above given, or, better still, with a very dilute solution of the acid alone, or of the mixture of nitric acid and salt, the image is gradually and completely converted into chloride. The action is quite different from that which occurs when hydrochloric acid is employed in a similar manner; the bleached image, instead of being a sickly, yellowish color, possesses a pearly whiteness, reminding one of the old alabastrian picture.

If, as soon as the solution is applied, a constant watch be kept on the *back* of the negative, the deepest shadows will gradually be noticed to assume the pearly tint spoken of; showing that the whole of the deposit constituting the fog or veil has been converted into chloride. A dip into clean hypo removes the chloride, leaving the shadows with a clearness and brilliancy scarcely obtainable by other means. In the case of half-tone negatives, experience alone can teach the proper moment to cease the action of the acid; but with black and white negatives the right time is instantly the veiled lines show white at the back of the plate.

The method of silver intensification is as follows: To a three grain solution of pyro a few drops are added of the following: silver nitrate, 60 grains; citric acid, 30 grains; nitric acid, 30 minims; water, 2 ounces. Dissolve the silver and citric acid separately, mix, and add the nitric. If a little sugar or glycerine be added, to help the intensifier to flow smoothly, the operation will be better performed by holding the plate on a pneumatic holder than in a dish, as the greater portion of the silver is, in the latter case, deposited on the dish. It will also economize silver.

After intensification and thorough washing, the plates are completed by a final dip in the acid-alum bath.

National Academy of Sciences.—Washington Meeting.

(CONTINUED FROM PAGE 272.)

Prof. T. Sterry Hunt, of Montreal, read a paper on the Cowles Electrical Furnace, recently invented by the Cowles Brothers, of Cleveland, O.

In this furnace the action is not electrical, though electricity is used as the means of generating heat, and with such success that the heat engendered far exceeds that by any previous process, and affords a powerful means of reducing refractory ores.

The furnace consists of a retort filled with charcoal in contact with the substance to be reduced. It is operated by passing an electric current through the mixture. It was found necessary to coat the particles of charcoal with lime in order to decrease their conducting power, and thus increase the intensity of the heat caused by the electric current. This coating was secured by wetting with lime water.

The intense heat melted the first furnace of fireclay, and a retort of carbon had to be substituted.

So great is the heat that a platinum wire is almost instantly melted; and an ordinary electric light carbon, plunged into the furnace for a moment, and then withdrawn, glows as the electric arc.

This furnace has been used to obtain the metal aluminum in a cheap form. For this purpose corundum is resorted to as the most practicable ore, common clay being too much mixed with sand or other impurities. It is believed that corundum may be obtained in large quantities at the cost of two or three cents a pound. Alumina in the form of corundum is immediately reduced to the metallic state aluminum.

In order to grasp the metal and retain it, copper is used to make an alloy, just as mercury does in the metallurgy of gold.

Quartz is melted in the furnace, becomes lighter, and a large part of the silicon is reduced.

Boracic acid gives fumes of boron, and the residual copper shows on analysis the presence of 3½ per cent of boron.

Manganese is also reduced, and an alloy containing 66 per cent of it was shown.

Alloys of aluminum with carbon, with silicon, and a peculiar alloy, believed to consist entirely of aluminum and nitrogen, were also shown.

Aluminum forms valuable alloys with iron. The addition of a small proportion of aluminum to iron reduces its melting point, without impairing its strength as carbon does. One-half of one per cent is sufficient for this purpose.

Titanium was reduced, but would not form an alloy with copper.

All easily reducible metals are conveniently obtained by this process, such metals as magnesium, potassium, and sodium being mentioned.

As yet, *pure* aluminum has only been produced in small lumps direct from the furnace, but it may be obtained by melting an alloy of aluminum and tin with lead, when the lead and the tin separate.

Another method of obtaining the aluminum pure is by subliming either an alloy of aluminum with carbon or one with copper, when the pure aluminum is carried over.

In aluminum bronze some silicon is always present, but that is no detriment. It is not yet determined whether or not the silicon can be separated.

The aluminum bronze, or the alloy with copper, is the most readily obtained, and hence the cheapest form of aluminum. The importance of these alloys is incalculable. Their economic value has long been understood, but their use has been limited by high price. Webster, of Birmingham, England, has for many years been the chief manufacturer, and has charged on the basis of 60 shillings (about $15) a pound for the aluminum contained in the mixture. The present process enables manufacturers to furnish it at $2.50 or in large quantities at $1.80 per pound in the form of 10 per cent alloy with copper, a pound of this mixture costing 30 cents.

The properties of aluminum bronze vary much with the proportion of copper and aluminum.

The maximum amount of aluminum which can be tolerated is 10 per cent, until we get near the other end of the scale, when mixtures of 70 or 80 per cent of aluminum, or more, give valuable workable alloys.

These bronzes have a general resemblance to those of copper with zinc.

Some large manufacturers have said that aluminum bronze could not be rolled, but it has been rolled successfully, and specimens were shown. It has also been drawn into wire, as shown, having a breaking strength of 109,000 pounds.

The addition of a small amount of aluminum to brass increases its strength remarkably; 2 or 3 per cent nearly doubles it.

It is strange that a metal which holds oxygen with such tenacity, when combined, should be so slow to enter into combination with it; yet, in fact, aluminum is almost untarnishable, and the alloys which contain 5 per cent or more seem to share this property. A specimen containing 2½ per cent, however, was shown to be tarnished by action of the atmosphere.

Specimens of aluminum silver were also shown. The addition of 4 per cent to German silver makes an alloy so tough that Cowles thinks razors might be made of it.

Silicon bronze is used for telegraph wires. The addition of one-half per cent of silicon greatly increases the strength, without materially reducing the conductivity of the wire. The Bennett-Mackay cable is made of this alloy.

In early experiments with the Cowles furnace, an engine of 30 dynamo power yielded a daily output of 50 pounds of 10 per cent alloy. Brush has now constructed an engine with 908 revolutions a minute, which for every 35 horse power reduces one pound of the alloy per hour. The expense of working is now covered by one-half cent an hour for one horse power; thus the cost of the alloy is 17 cents a pound.

Within a week, the gases given off by the furnace have been analyzed. In the early part of the process it is found that a large amount of nitrogen was given off, showing that air leaks into the furnace. After an hour and a half, the nitrogen is much diminished.

They at first used moist carbon for packing, but have now reformed that, thereby saving the waste of fuel in drying out the moisture.

In the ensuing discussion, Mr. Sellers, of Philadelphia, remarked that he had made a series of experiments at iron works in that city, in the use of aluminum with iron, which gave what is technically called "dead melting" in two or three minutes, instead of an hour, as required by previous method. The result was very fine castings, and absence of flaws, which so often vex the founder, in using the process generally employed.

The entire number of papers read was twenty-six, many being technical as usual.

Prof. Ogden N. Rood, of Columbia College, gave an account of a series of experiments on color contrast, whereby it appears that colors appearing on neutral ground to the eye, as a result of contrast with those seen, are not, as is generally supposed, complementary, except in the case of red; and in proportion as the violet end of the spectrum is approached do the contrasted colors differ more and more from the complementary ones. He found also that bluish colors affect the eye more than reddish ones. The reason of these physiological actions he was unable to explain.

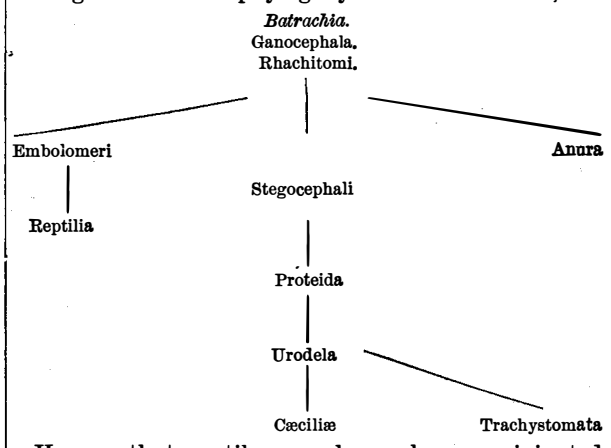
Prof. H. A. Rowland, of Johns Hopkins University, gave a valuable exposition of the absolute and relative wave lengths of lines of the solar spectrum, remarking that Angstrom's determinations were no longer sufficient, because of the superior accuracy of modern instruments. Rowland regards his own determinations as correct within one or two parts in half a million.

Prof. A. Graham Bell gave a further contribution to the study of heredity in relation to deaf-mutism, taking in hand, this time, the families of Martha's Vineyard. An important fact noted was that, notwithstanding the repeated intermarriages on the island, and the fact that the families investigated were scattered all over the island, all but two of the deaf mutes were found in the township of Chilmark, which contains the smaller part of the population, and in which town four per cent of the people are deaf mutes.

Doctors speak of the prevalence of typhoid fever in Chilmark, and even note a definite boundary within which it prevails, calling it the typhoid fever line, showing that the influence of environment is more potent than that of heredity.

A few of the papers proposed new or modified classification, which met with such thorough and unanimous approval that the schemes presented are subjoined, and are believed to mark the final results attained by science in the departments named.

Prof. E. D. Cope, of Philadelphia, now gives the following scheme as the phylogeny of the Batrachians, viz.:



He says that reptiles, as above shown, originated from a batrachian type.

Prof. Theodore Gill, of Washington, classifies fishes as follows, four classes:

1st. Leptocardians, or lancelets.
2d. Mydonts, or lampreys.
3d. Selachians, or sharks and rays.
4th. Teleostomes, or true fishes.

He remarks that these are entitled to be called classes rather than orders, being more widely separated from each other than the orders of either reptiles or birds.

The brain furnishes the best indication for classifying the major groups, and the osseous system for general grouping.

Almost all orders of fishes are of recent introduction. In the Devonian formation are seven or eight orders, all but one extinct; and no living order has there a representative, except dipnoi.

Prof. Charles D. Walcott, of Washington, proposes the following classification of the rocks above and below the Cambrian of North America:

PALEOZOIC.	Carboniferous:	Permian, Coal measures, Lower carboniferous.
	Devonian:	Catskill, Chemung, Hamilton, Corniferous.
	Silurian:	Oriskany, Lower Helderberg, Niagara.
	Ordovician:	Cincinnati, Trenton, Chazy, Calciferous.
	Cambrian:	Potsdam, Georgia, St. John.
?	Keweenaw:	Keweenaw series, Grand Canon series, Llano series.
	Huronian:	Lake Superior, Minnesota, Newfoundland.

He would further classify the Cambrian rocks as follows:

Upper Cambrian:	Potsdam, Knox, Tonto.
Middle Cambrian:	Georgia, L'Anse au Loup, Prospect.
Lower Cambrian:	St. John, Braintree, Newfoundland, Wasatch, Tennessee.

Prof. Hunt commended this scheme as the best yet presented, especially approving the separation of the Ordovician. It was formerly supposed that the Potsdam contained the earliest forms of life, but Prof. Walcott has shown fossils from the lowest Cambrian, and has at least cast doubt upon the Keweenaw and Huronian.

The fall meeting of the Academy will be held at Boston, commencing Nov. 9, 1886. W. H. H.

CONCRETE CONSTRUCTION.

Concrete may be described briefly as pieces and particles of rock or like material aggregated together with lime or cement. The origin of its manufacture is unknown. The massive ruins in Italy testify to its durability and of its extensive employment by the Romans. Since the introduction of Portland cement, the use of concrete has greatly extended. In England, where the first cement was manufactured, Drake states that thousands of concrete buildings have been erected of late years. The great desirability of concrete as a building material is well recognized, and rapid strides are being made in its application. Rapid as has been the increase of concrete building during the past few years, the progress would have been still greater had it not been hindered by the general lack of knowledge on the subject, the great cost of moulding or shaping the material, and the want of adequate appliances for mixing the concrete.

There are many localities where sand rock or gravel can be obtained at a nominal cost, in which concrete could be profitably introduced by any metallurgical man. And in these same districts are men plodding along in the grooves of better known trades who, by turning their attention to concrete construction, could establish themselves in a good business.

To accomplish the best results in this class of construction, it will be advisable to consult Mr. Ransome, who has had great experience in this class of work, and obtain the right of using his patented apparatus, with which buildings can be put up with unskilled laborers, provided the men are intelligently directed.

On this page we give an illustration of a building in process of erection on the system invented by Ernest L. Ransome, of this city. Mr. Ransome has received patents covering building construction, concrete mixer, and a concrete apparatus for moulding walls, houses, and other buildings.

The engraving gives an isometrical view of a building in course of erection, with part of the scaffolding removed. Ransome apparatus for moulding the walls consists of slotted standards, which being placed in pairs, one on either side of the site of the wall, and bolted together, hold in place the mouldboards, between which the concrete is placed. These standards are arranged to slide upward upon the outer face of the mouldboards as the wall progresses, and are made to conform to any breaks or projections that may be required in the building.

The moulding boards may be of any size. If they are permanently required for the apparatus, they should be surfaced and squared, and about 1¼ inches thick, 6 to 12 inches wide, and as long as could be conveniently obtained or handled. If, on the other hand, by reason of the location or other causes, they are only needed temporarily for this purpose, then their dimensions should be determined by their future use. For instance, if they are subsequently needed for flooring, then flooring could be used; if fencing is wanted, then use fence boards; if planks are required, then let planks be taken. In using them for the mould, the boards or planks are but little damaged; the bolt holes required in some of them are not large, and could easily be filled up.

Ordinary bolts may be used for connecting the standards together, but those having winged nuts will be found more convenient. The washers should be of good size.

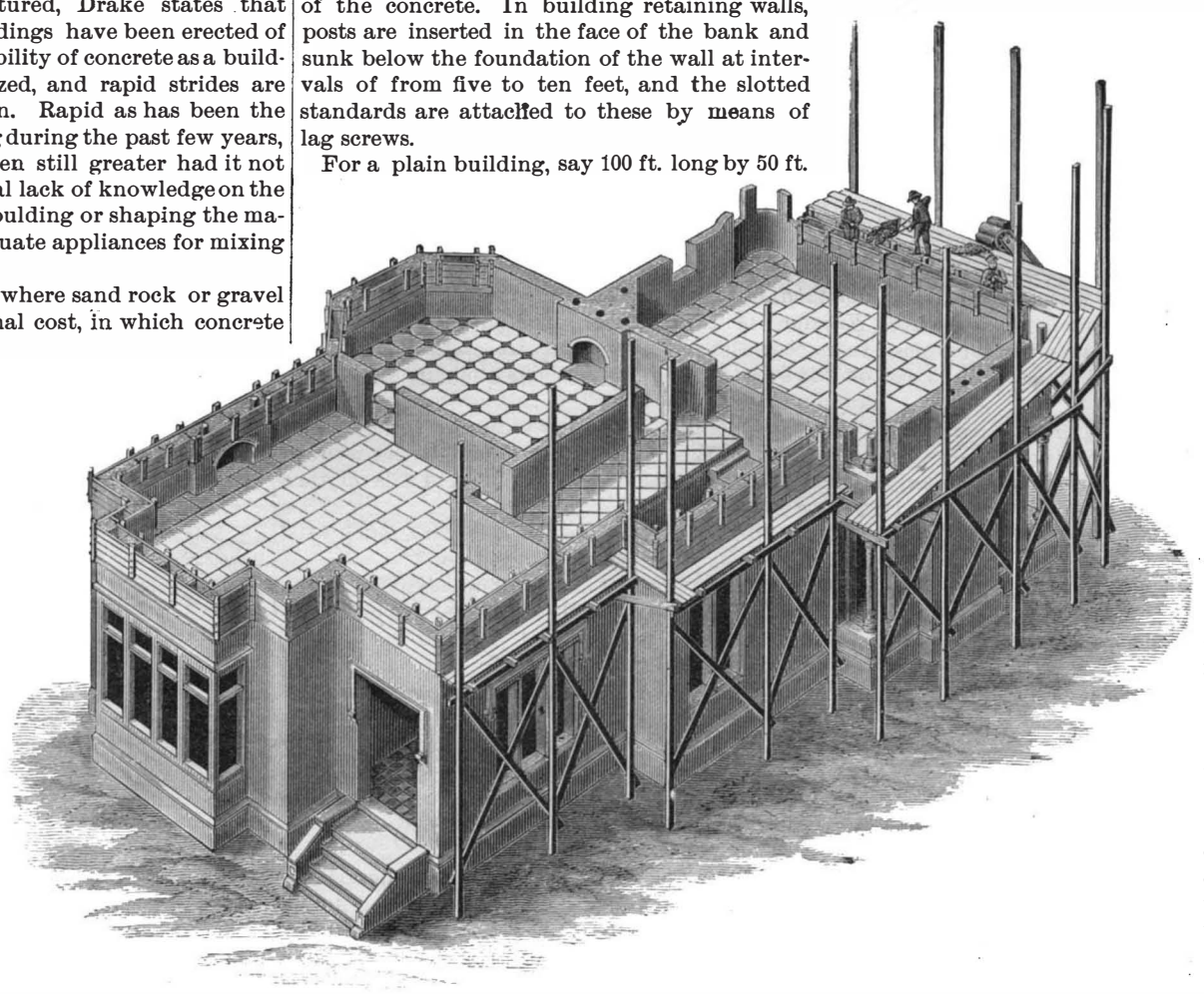
The *modus operandi* is as follows: The foundations being prepared and the standards and lower moulding boards all in position, concrete is put into the mould continuously, layer after layer. Moulding boards are added from time to time, as needed, until the concrete is brought to about the top of the standards. The bolts are then slackened, a set at a time, and the standards pushed up a few inches, or a foot or two, dependent upon the character of the work.

As soon as the lower bolts are in the way of the upward movement of the standards, they are withdrawn and replaced at the top of the slot. The moulding boards, liberated by these movements, are reused above those already placed as often as needed.

This action is repeated as often as may be necessary to obtain the height desired. It forms a continuous operation, and offers no interruption to the filling in of the concrete. In building retaining walls, posts are inserted in the face of the bank and sunk below the foundation of the wall at intervals of from five to ten feet, and the slotted standards are attached to these by means of lag screws.

For a plain building, say 100 ft. long by 50 ft. wide and 50 ft. high, the cost of the apparatus, irrespective of height, would not exceed $150, and the expense of working it would not be more than a cent per cubic foot of concrete. After building a wall, the apparatus is good for ten or twenty more. By this system the first cost is small and the expense of working slight. There is no difficulty in keeping the wall plumb, and there is no trouble in moulding projections if desired.

The large factory and warehouse recently built for the Arctic Oil Works, on the Potrero, were constructed after this manner by the patentee of the system. The fireproof roof of the warehouse was also built by him. Mr. Ransome has built many concrete foundations for buildings, machinery, etc., the largest being that of the Starr & Co. Mills, at Wheatport, Contra Costa County. The foundations of this mill were all built of concrete. In the piers, arches, and floor platforms there are 140,000 square feet of concrete. Mr. Ernest L. Ransome, whose office is at 402 Montgomery Street, San Francisco, California, is prepared to rent tools, sell licenses and territorial rights for his various inventions in connection with concrete construction, and give suitable instruction so that people can build for themselves.



ISOMETRIC VIEW OF CONCRETE BUILDING IN COURSE OF CONSTRUCTION.

ART IN THE GARDEN.—A CIRCULAR PATH.

SUGAR, glycerine, and gum arabic are the articles used to produce the glossy appearance of ink.

The Ordinary Vest a Poor Lung Protector.

Mr. James Hess makes a very sensible suggestion, it seems to us, in the *Herald of Health*, when he calls attention to the absurdity of our present curious habit of wearing cambric-back vests, while the fronts are of heavy material and sometimes wadded, and urges the propriety of protection for both sides of the lungs. The habit of course has grown from a belief that the outer coat is sufficient protection for the back, while the chest needs warmer covering on account of the coat being open. But it seems a disproval of the reasoning that the first unpleasant sensations of chilliness are the so-called "creepers" running down the spine. Even when the warmest woolen material is selected for a suiting, the tailor, unless otherwise ordered, will invariably make the back of the vest of some thin, flimsy material, like cambric or silk, though he may deem it advisable to pad the front with cotton wadding. There is no proper reason why the back of the vest should be made so insufficient. The front may be made uncomfortably thick and still fail to protect the lungs, unless the back is made equally thick and warm. In front they are protected about five times as much as in the back by clothing, ribs, flesh, muscle, and fat. In the back, the lungs almost come to the surface, and therefore need more protection. Mr. Hess asserts that it has been his custom for two years past, and that many gentlemen to whom he has mentioned the matter have had their vests made with good, warm backs, and after a winter's trial are quite enthusiastic over the change.

They have passed through the entire winter and spring without once taking cold, which is the best evidence in support of the thick vest-back proposition that could be adduced.

THE LAYING OUT OF GARDEN PATHS.

Where a garden is to be laid out in a perfectly flat situation, there is not, of course, the same scope for effective ornamentation as can be produced where there is a diversity of surface. One means, however, of dealing with level ground is to provide oval and circular and serpentine paths, with plainly marked borders, but so that, to the eye, the lines of the borders will be broken by trees and shrubbery, and the complete plan will not be suggested from what can be seen at any one point. Such walks should, wherever possible, lead to or by some bright little spots which one will come upon unexpectedly, and the surprise of which will heighten the pleasure obtainable from the beauty of the scene. An idea of thus laying out a circular walk may be obtained from the accompanying illustration, the planting of quick-growing shrubbery giving extension and outline to a general direction of paths, which would be governed by any growth, as of trees, that would require years to mature. When a general plan has once been adopted, however, it should be carefully kept in view in all future work in the garden, and the pruning and planting kept steadily in line with the plan laid out.

TOBACCO blindness is becoming a common affliction. At present there are several persons under treatment for it at one London hospital. It first takes the form of color blindness, the sufferers who have smoked themselves into this condition being quite unable to distinguish the color of a piece of red cloth held up before them. Sometimes the victim loses his sight altogether. Although smoking is to a large extent the cause of the malady, heavy drinking is also partly responsible.

ENGINEERING INVENTIONS.

A feed water regulator has been patented by Mr. Alexander J. Aderhold, of Birmingham, Ala. It is a balance valve regulator in which the entire valve, stem and all, is inclosed within the stem and water chamber within which it acts, and which requires no stuffing box for its stem, the construction being simple and such as to avoid friction of parts and liability to stick.

A car coupling has been patented by Mr. William H. Moore, of Elsie, Mich. The coupling hook is pivoted to swing vertically, its prong being at the front end of the drawhead, a spring pressing the hook downward, and a shaft journaled transversely in the drawhead extending to the sides of the car to operate a cam by which the action of the coupling hook can be controlled.

A rotary engine has been patented by Mr. George W. Bond, of Fort Wayne, Ind. Combined with a wheel having peripheral buckets with their front edges concaved, is a segmental steam box having rotary bearings upon the edges of the buckets, the exhaust pipe taking the exhaust from the lower end of the steam box, the engine being simple in construction, and intended to utilize the steam to the greatest advantage.

A hydraulic engine has been patented by Mr. Charles R. Whittier, of Yonkers, N. Y. It is of that class in which the piston is stationary and the cylinder is caused to reciprocate by the inflow and discharge of water, the construction being such that only small counterbalancing weights are required, and the cylinder may be made comparatively short, no equalizing pipe to equalize the pressure of water in the cylinder being required.

A smoke preventing furnace has been patented by Mr. William Latham, of South Cleveland, O. It is designed to prevent the formation of smoke by securing a perfect combustion, employing therefor an injector operated by steam to carry in a blast of air to a hollow trunk in the bridge wall, where it issues in jets and mingles with the products of combustion, the invention covering a novel combination and arrangement of parts.

MECHANICAL INVENTIONS.

A convertible drill press or slotting machine has been patented by Mr. Laurence H. Pierson, of San Francisco, Cal. It has a traveling head carrying a contrivance for converting the up and down motion into a rotary one, a frame on which the head is adjustable, a standard supporting the frame and directly attachable to the work to be slotted or drilled, with feeding devices and other novel details.

AGRICULTURAL INVENTIONS.

A mowing machine has been patented by Messrs. Walter B. Cox and John McDonough, of New York city. It has a horizontally revolving cutter arranged to act in connection with relatively stationary fingers, the cutter blades being at an angle of forty-five degrees to the inclined forward edges of tangential arms, the opposite edges of the blades being beveled, so when a blade is dulled it may be reversed and its sharp edge be used.

MISCELLANEOUS INVENTIONS.

A ruling machine has been patented by Mr. Thomas W. Wharmby, of Cleveland, O. This patent relates to the laying mechanism and drop boxes of paper ruling machines, the ruled sheets passing over concave rollers as they are discharged, to prevent the corners from turning down.

A flower pin has been patented by Mr. Howard L. Kranz, of Providence, R. I. Combined with a brooch having a slot is a clasp extending through the slot, and acted on by a spring, whereby a bouquet or bunch of loose flowers may be conveniently attached to any part of the dress.

A penholder has been patented by Mr. Samuel S. Rogers, of Assotin City, Washington Ter. It is adapted to attach the holder to the hand at one angle, and for holding and guiding it, in connection with a fountain and a mechanism for regulating the supply of ink to the pen.

A shaft tug has been patented by Mr. George M. Sicklesteel, of North Branch, Mich. It is a novel device, intended to prevent the shaft or thills from dropping, even if the brace or whiffletree breaks, and also to prevent the vehicle from running on the horse in case of the breaking of the shaft or tree.

A rotary shuttle for sewing machines has been patented by Mr. Carl Junker, of Carlsruhe, Germany. It is a uniformly vertically rotating shuttle of semicircular shape held by the driver, the axes of the spool and shuttle being coincident, the invention being an improvement on a former patented invention of the same inventor.

A roller skate has been patented by Mr. Burt E. Tilden, of Youngstown, O. This invention provides an improved brake for roller skates, a brake shoe of leather, rubber, or other suitable material, with its rubbing surface outwardly convex, being so held at the rear of the skate that it can be conveniently adjusted to any desired height.

A piano wagon has been patented by Mr. John D. Lindsley, of Hiawatha, Kansas. It is provided with windlasses and ropes, skids and various attachments for holding and managing the piano, to promote the safety of the instrument during loading or while in transit, and to lessen the labor of piano moving.

A grab hook has been patented by Mr. Sylvester Byrne, of Philadelphia, Pa. Grabbing levers are pivoted on a rod, with springs acting on the levers, and arms for locking levers in place, making an improved implement for automatically grabbing persons in the water and holding them, and one which can also be used by firemen.

A horseshoe has been patented by Mr. Daniel Cruice, of New York city. It is formed with a thickened portion at the toe and thin portion at the heel, in combination with heel and frog supports, the shoe being offset at its upper surface, and with thin pockets or depressions in the lower surface which will tend to prevent the horse slipping.

A truss pad has been patented by Mr. Alonzo D. Smith, of New Woodstock, N. Y. It is a centrally apertured pad combined with a smaller pad closely fitted to the aperture, the smaller pad being arranged opposite the hernial opening, while the larger pad supports the abdominal walls around, a spring connecting the smaller and larger pads.

A carpet stretcher has been patented by Mr. Osman C. Du Souchet, of Warsaw, Ill. A rack bar is passed through a box, and there is a clamp with its pivoted jaws on opposite sides of the end of the rack bar, with means for operating the rack bar, and other novel features, making a carpet stretcher which will be strong and durable and easy to operate.

A shirt has been patented by Mr. Jacob Lederer, of New York city. It has front and rear reenforcing pieces reaching along the edges of the yoke to the arm hole, thence around the arm hole and joined beneath it, in order to render the shirt strong where the most wear and strain comes, without making it heavy and uncomfortable.

A stamp canceler has been patented by Messrs. Edward A. Luzenberg and Edward Sachs, of San Antonio, Texas. It is made to force metal teeth through a rubber part of the canceler which has been inked, and thus perforate the stamp and ink it at the same time, but so as not to mutilate the letter or other contents of the envelope,

An artificial fly has been patented by Mr. Wakeman Holberton, of Hackensack, N. J. The wings are so attached to the body of the insect that they will collapse or close when casting the fly, thus reducing the air resistance, rendering the fly less liable to become detached, and causing the parts to expand and have a life-like motion in the water.

A turning machine has been patented by Mr. Abraham Stoner, of Stony Point, La. It is more particularly intended for forming vessels or tubs from blocks of the tupelo gum tree, the wood of which when dried is very white, light, and difficult to split by mechanical means, the machine operating automatically, and designed for making vessels of various sizes and shapes.

A street washer has been patented by Mr. Frederick Chapman, of Brooklyn, N. Y. It is a box set immediately over and in connection with the water main, closed by a removable cover, and with suitable easily operated valve fittings, whereby the apparatus will be wholly protected from becoming clogged by the entrance of dirt to the movable parts.

A mosquito canopy for bedsteads has been patented by Mr. Nicolai Petersen, of Charleston, S. C. The construction is such that the canopy is sustained by cords, the supporting arms and their joints being removed from the range of entanglement with the netting when folded, the invention being an improvement on a former patented invention of the same inventor.

A fire escape has been patented by Mr. David H. Dillman, of Fredericksburg, Pa. It consists of an endless ladder adapted for attachment to the cornice or side of a building, contiguous to a window or other place of exit, and to operate automatically when a person steps upon the ladder, so as to convey one to the ground in safety.

A thill coupling has been patented by Mr. Benjamin Ligget, of Tucson, Arizona Ter. The object of this invention is to do away with the ordinary form of bolt and nut, the bolt being held in place by the action of a spring, and the bolt being only slotted at its head, so the band will constantly press the inner face of the head against one jaw of the clips, and prevent rattling or accidental displacement.

An automatic cut-off for gas burners has been patented by Messrs. Thomas J. L. Smiley and Charles H. Stombs, of San Francisco, Cal. This invention includes a gravitating valve and thermostatic fingers or springs, and is applicable both to double and single tip burners, constituting a life-saving gas burner, which will do away with possibility of accident from the escape of gas from burners to which it is attached.

A seal press has been patented by Mr. Emory Q. Darr, of Shelbyville, Ind. It has a handle-carrying die, a spring hammer carrying a corresponding die, and an actuating mechanism of a dog engaging a trigger, the device being conveniently made in the form of a small pocket pistol, or in such form that it can be readily carried in the pocket, to be easily available by notaries and others.

An electrical cut-out has been patented by Mr. John M. Fairchild, of Portland, Ore. This device provides for the ready cutting out of an electrical current by any one from a building in case of fire, etc., but has a rotary adjustable switch bar and contacts, a separable key, and other details, whereby the locking or turning on can only be done by a specially authorized person.

A whiffletree coupling has been patented by Mr. Hiram C. Brown, of Winsted, Conn. It consists of a bolt with a curved arm formed on its head and a plate with an apertured lug for the reception of the end of the curved arm, with other details, whereby the whiffletree will be held from tilting forward when subjected to a draught, and so it will always work freely upon its bolt.

A road cart has been patented by Mr. Samuel Coles, of Valhalla, N. Y. A cross bar with convexed upper surface is secured upon the shafts, and the body is independently balanced upon the cross bar, with other features, whereby the cart will not be affected by the horse motion, and the horse can be driven with a loose girth, the girth having nothing to do with the motion of the cart.

A process of making explosive compounds has been patented by Mr. Milton F. Lindsley, of North Bergen, N. J. A mechanical mixture of wood fiber, charcoal, bituminous coal, and starch is powdered, made into grains, treated with acids, and then with carbonate of potash and saltpeter, making an explosive agent mainly of nitro-cellulose, but adapted for use in all kinds of firearms.

A device for regulating and enriching illuminating gas has been patented by Messrs. Lewis B. White, Daniel Jackson, and Martin Van Buren, of New York city. It has an annular funnel-shaped vessel for receiving hydrocarbon, in connection with a specially contrived governor, whereby the gas may be regulated automatically according to the pressure, or may be made to circulate among the heated hydrocarbons of the apartments of the gas-enriching attachment.

A spirit level for boring bits forms the subject of two patents which have been issued to Mr. Wm. E. Gwyer, of New York city. Its construction is such that when the bit is vertical an air bubble will be exactly in the center of the spirit bottle, and the least variation of the bit from a vertical position will cause the air bubble to move away from the center, so the operator can always know when he is boring a vertical hole; another device of suspension hooks, stem, and balancing weights enables the operator to bore holes exactly horizontal.

NEW BOOKS AND PUBLICATIONS.

GEOLOGICAL SURVEY OF NEW JERSEY. ANNUAL REPORT OF THE STATE GEOLOGIST FOR 1885. Trenton: State Printer.

Under the direction of Professor George H. Cook, the Geological Survey of New Jersey has become one of the most creditable of the many undertaken by the different State governments. While New Jersey offers but a limited field for geological study as compared with some of the other States, the topographical work of the survey is scarcely inferior to even the magnificent maps prepared by the national corps under either the Coast or Geological Surveys. Eleven years have now been spent upon the the topography of the State, and it is calculated that about two more years will be required to complete the work. But perhaps the best feature of the Survey is its practical value to the people of the State. This is, after all, the highest purpose of such a work. A particular effort has been made to include in these investigations the questions which have a direct bearing on industrial matters, and, as a result, to furnish information which will be personally useful to the citizens who have contributed toward its maintenance.

THE MICROSCOPICAL BULLETIN. James W. Queen & Co., Philadelphia.

This little bimonthly publication contains matter which is of interest to microscopists, and the price (25 cents a year) is so small that every one interested in microscopical subjects can afford to have it.

Business and Personal.

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

How to Meet Customers.

Inventors and manufacturers should exhibit at the Minneapolis Industrial Exposition. Opens August 23, closes October 2. Finest building in the country; 7½ acres floor space. Power and space free. Building in center of city; 160,000 people; 400,000 within radius twenty miles. Entire Northwest tributary. Address, for full particulars, William M. Regan, Minneapolis, Minnesota.

$3,000 will buy the right to patent Morgan's U. S. patent Horse Hay Fork Returner in Canada. Big bonanza. Address John H. Morgan, Jr, Aurora, Ill.

Send to the *Railroad Gazette*, 73 Broadway, New York, for a catalogue of Locomotive, Track, and other railroad books.

Emery Wheels of unusually superior quality for wet grinding. The Tanite Co., Stroudsburg, Monroe Co., Pa.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Pumps for liquids, air, and gases. New catalogue now ready.

Wanted—To correspond with a practical door, sash, and blind maker; one who would be fully competent to take full charge of a factory and could give correct estimate of machinery needed, cost of manufacture, probable demand and margin. One that could take an interest would be preferred. Address Mr. H. H. Durkee, 48 Broad St., New York.

Wanted—Patented articles of merit to manufacture on royalty. Electric Mfg. Co., 311 River St., Troy, N. Y.

Curtis Pressure Regulator and Steam Trap. See p. 142.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. $100 "*Little Wonder.*" A perfect Electro Plating Machine. Sole manufacturers of the new Dip Lacquer Kristaline. Complete outfit for plating, etc. Hanson, Van Winkle & Co., Newark, N. J., and 92 and 94 Liberty St., New York.

Grimshaw.—Steam Engine Catechism.—A series of thoroughly Practical Questions and Answers arranged so as to give to a Young Engineer just the information required to fit him for properly running an engine. By Robert Grimshaw. 18mo, cloth, $1.00. For sale by Munn & Co., 361 Broadway, N. Y

Send for catalogue of Scientific Books for sale by Munn & Co., 361 Broadway, N. Y. Free on application.

The Knowles Steam Pump Works, 44 Washington St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

"*Imitation is the Sincerest Flattery.*"

If the above quotation is true, then Dr. R. V. Pierce ought to feel highly flattered on account of the many imitators of his popular remedy, the "Pleasant Purgative Pellets," for they have scores of imitators, but never an equal, for the cure of sick and bilious headache, constipation, impure blood, kidney pains, internal fever, and all bowel complaints. With a bottle of the sugared granules in the house, you can dispense with the family doctor and his often nauseous medicines.

Haswell's Engineer's Pocket-Book. By Charles H. Haswell, Civil, Marine, and Mechanical Engineer. Giving Tables, Rules, and Formulas pertaining to Mechanics, Mathematics, and Physics, Architecture, Masonry, Steam Vessels, Mills, Limes, Mortars, Cements, etc. 900 pages, leather, pocket-book form, $4.00. For sale by Munn & Co., 361 Broadway, New York.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Catarrh, Catarrhal Deafness, and Hay Fever permanently cured by a new treatment, in from one to three simple applications, made at home. Send stamp for descriptive pamphlet to

Dixon & Son, 303 West King St.,
Toronto, Canada.

Nystrom's Mechanics.—A pocket book of mechanics and engineering, containing a memorandum of facts and connection of practice and theory, by J. W. Nystrom, C.E., 18th edition, revised and greatly enlarged, *plates*, 12mo, roan tuck. Price, $3.50. For sale by Munn & Co., 361 Broadway, New York city.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 46.

Hercules Lacing and Superior Leather Belting made by Page Belting Co., Concord, N. H. See adv. page 238.

Cutting-off Saw and Gaining Machine, and Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Billings' Patent Adjustable Four and Six Inch Pocket Wrenches. Billings & Spencer Co., Hartford, Conn.

New Portable & Stationary Centering Chucks for rapid centering. Price list free. Cushman Chuck Co., Hartford, Conn.

The Crescent Boiler Compound has no equal. Crescent Mfg. Co., Cleveland, O.

Wm. Frech, Sensitive Drill Presses, Turret and Speed Lathes combined, Power Punching Presses, 68 W. Monroe Street, Chicago.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Hoisting Engines. D. Frisbie & Co., Philadelphia, Pa.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p. 158.

Astronomical Telescopes, from 6" to largest size. Observatory Domes, all sizes. Warner & Swasey, Cleveland, O.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) W. T. S. asks: How many feet board measure, allowing ¼ of an inch for the kerf of the saw, in a stick of timber 48 feet long, 10 inches by 10 inches square? A. If you sell the stick of timber at board measure, no allowance should be made for resawing, and it should tally 400 feet board measure. If allowance is agreed to for resawing, the stick will cut seven 1 inch boards and one 1¼ inch board or plank, and should then tally for the whole stick 330 feet board measure.

(2) W. S. L.—It will take 6 horse power for machines you mention. We could not in Notes give large examples and details.

(3) G. J. S.—Sheet copper is somewhat variable in its tensile strength; hard rolled copper 36,000 pounds, soft copper 24,000 pounds, is the utmost strength per square inch. Thus a ⅛ inch sheet will tear asunder at from 750 to 1,100 pounds per inch width. Allow ¼ of this as a safe load. To make sure, say 200 pounds, which divide by the pressure you wish to carry. Gas pipe will stand 500 to 1,000 pounds pressure.

(4) S. F. L.—Your 1 horse power engine will run a light 18 foot boat with a good form of 3 blade propeller, 16 inches in diameter. Would not recommend a paddle wheel for so small a boat. We advise you to inspect the numerous small steam yachts in your vicinity.

(5) W. F. R. asks: 1. What material is the best to paint a tin roof? A. Prince's metallic paint and boiled linseed oil. 2. How can I make human manure into a fertilizer? A. By mixing with dry soil. 3. What is the best plan to build a private icehouse—above or below ground? Give me the best plan for both. A. Below ground, all but roof. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 59, 55, 99. 4. I have two large skylight glasses that are cracked across. What can I use to stop them from leaking? A. Putty a strip over the cracks, or put in a new light. 5. What is the best soldering fluid to use on an old tin roof, that has been painted with tar? A. Tinner's acid, zinc dissolved in hydrochloric acid, and add a

little sal ammoniac. Scrape the tin where you intend soldering. If at all possible, use rosin, as it makes a better job than acid. 6. How can I make whitewash that will not rub off? A. Put a little white glue in the whitewash. 7. What is the name of the best brand of tin that is made? A. There are over three hundred brands in the tin trade; generally, the more letters, as X, XX, XXX, etc., the thicker the tin.

(6) In answer to P. D. P., March 27 (in regard to boiler feed pipe and heater pipes becoming partly filled with hard lime scale), E. A. T. writes: I would say, cut a piece of pipe one or one and a half inches larger diameter than your blow-off or feed, and slip it over it or them wherever they are exposed to great heat, and you will never have any more trouble with their filling up. I learned this from my SCIENTIFIC AMERICAN ten years ago or more, and it has been worth a great deal to me in that time.

(7) F. T. R.—Nitric acid dissolved in twenty to thirty parts of water is used to etch zinc with. An excellent liquid to be used in writing on zinc is ¼ ounce platinum chloride dissolved in 1 pint soft water. It is very expensive. This solution must be kept in glass, and the writing executed with a quill pen.

(8) A. H. asks: Of what shall we compose composition for making job printing press inking rollers? A. To 8 pounds transparent glue add enough water to cover it; let it stand with occasional stirring 7 or 8 hours. After 24 hours, all the water should be absorbed. Heat it in a water bath, as glue is always heated as soon as melted, and when both rise, remove from fire, and add 7 pounds molasses that has been made quite hot. Heat with frequent stirring for half an hour. The moulds should be clean and greased. Pour into moulds after it has cooled a little, and allow to stand 8 or 10 hours in winter, longer in summer. Some use far more molasses, three to four times above quantity, and less water. In this case, after soaking 1 to 1½ hours, the glue is left on a board over night, and then melted with addition of no more water, and three or four times its weight of molasses added. Two hours' cooking is recommended in this case.

(9) W. A. M. asks: If horseshoe magnets are made of fine quality of 18 gauge sheet steel, small in size, polished and nickel plated, would it be necessary to harden the steel to have them retain their magnetism? Would they be more powerful if hardened? A. They will retain more magnetism if hardened, and therefore will be more powerful.

(10) H. C. B. desires a recipe for making a peacock green stain which will penetrate into wood. A. A green stain is produced by a solution of verdigris in nitric acid; then, by dipping into a hot solution of pearl ash, the color may be changed into blue. By varying the strengths of the solutions used, the exact shade desired by you can be obtained.

(11) C. H. T. asks how to make bay rum from the bay oil. A. Take 10 fluid drachms oil of bay, 1 fluid drachm oil of pimento, 2 fluid ounces acetic ether, 3 gallons alcohol, and 2½ gallons water. Mix, and after two weeks' repose, filter.

(12) C. A. K. asks the process for tempering steel springs in the shape of rings 11 inches in circumference. A. Such a spring should be heated in a muffle or oven, lying upon a plate of iron. When at a cherry red heat, it should be dropped in the water edgewise so as to keep its shape. This may be done by dexterously and quickly turning the plate over, so that the spring may drop edgewise. A wire frame is sometimes used, and the spring heated in a charcoal fire and handled by a wire loop, from the frame.

(13) J. S. asks: What will precipitate copper and gold in a cyanide solution? A. They can be thrown down as sulphides by means of hydrogen sulphide, and then brought into solution again by boiling with potassium chlorate and hydrochloric acid. Then the gold can be separated out by adding iron sulphate.

(14) H. W. B. asks: How can I bronze a plaster cast? A. Go over the figure with isinglass size, until it holds wet, or without any part of its surface becoming dry; then with a brush go over the whole, taking care to remove while it is yet soft any of the size that may lodge on the delicate parts of the figure. When it is dry, take a little thin oil gold size, and with as much as just damps the brush go over the figure with it, allowing no more to remain than causes it to shine. Set it aside in a dry place free from smoke, and in forty-eight hours the figure is prepared to receive the bronze. After having touched over the whole figure with the bronze powder, let it stand another day, and then with a soft dry brush rub off all the loose powder, particularly from the points or from the more prominent parts of the figure.

(15) W. S. desires a recipe for making a cheap varnish for varnishing furniture. A. The following is a fine, lustrous polish for furniture: Half pint linseed oil, half pint old ale, the white of an egg, one ounce spirits of wine, one ounce spirits of salts. Shake well before using. A little to be applied to face of soft linen pad and lightly rubbed for a minute or two over the article to be restored, which should be first rubbed off with an old silk handkerchief. It will keep any length of time if well corked.

(16) R. W. W. desires a receipt to make a good water stain to imitate walnut, not to cost too much. A. Take of burnt umber 2 parts, rose pink 1 part, glue 1 part, water sufficient; heat all together and dissolve completely. Apply to the work first with a sponge, then go over it with a brush, and varnish over with shellac.

(17) G. W. H. asks the composition of a fuzee, or large scented match, which when ignited perfumes the air around? A. Dissolve ¾ ounce niter in ½ pint rose water; mix this with ½ pound willow charcoal, and dry it thoroughly in a warm place. When the nitrated charcoal is perfectly dry, pour upon it a mixture of ½ drachm each of the attar of thyme, caraway, rose lavender, cloves, and santal; then stir in 6 ounces benzoic acid. Mix thoroughly through a sieve, then beat in a mortar with sufficient mucilage to bind together. Make into pastils, and dry.

(18) H. M. B. desires a formula of plastic compounds that soften easily by gentle heat, and are easily worked into shape and position by gentle pressure, and will then set rapidly. A. The following mixture, used for making photo. gelatine plates, may be applicable: 70 parts of bitumen are melted at a moderate heat, and to the melted bitumen there are added the following, each being melted previously: 425 of spermaceti, 200 of stearine, and 170 of white wax. All these being incorporated, 70 parts of finely ground black lead are stirred in. This preparation is poured over plates at a temperature of about 40° Centigrade.

(19) J. S. W. asks as to the use of a spray of water for reducing the temperature of a room. A. It may be done by a spray fountain or a spray jet thrown against a muslin curtain. Any means to produce a large evaporating surface supplied with water (cold if possible) will accomplish your purpose.

(20) J. N. W. asks the formula for map engravers' wax. A. You can use a preparation made of 4 ounces of linseed oil, half ounce of gum benzoin, and half an ounce of white wax; boil to two-thirds.

(21) P. R.—To temper a machinist's tap, take a piece of iron pipe or old boiler flue, and plug one end by welding. With equal parts of clean white sand and pulverized charcoal, pack your tap in the center of the pipe. Heat evenly in a large fire to a full cherry red; keep it in the fire until assured that the tap is heated through. Then draw the tap from the sand bath, and dip perpendicularly in clear water at a temperature of 70°. Do not let the water splash up on the tap, as it chills the teeth above the water, which prevents their hardening. It should require about 2 seconds to immerse if the thread is 6 inches long. A little experience is worth a page of advice. Quality of steel is of vital importance in hardening.

(22) W. M. R. asks: 1. When water gets low in a steam boiler, and water is pumped in and it explodes the boiler, what is the cause of the boiler exploding? A. Excessive generation of steam by the overheated iron forming the shell and tubes of the boiler. 2. Does water bubble up and down in a boiler like a tea kettle when there is pressure on the water by steam? A. Yes; when boilers are said to foam, their action much resembles a kettle that is boiling over. 3. How many degrees Fahrenheit does iron have to be over 212° Fah., when you put water on it, that it will not generate steam? A. The so-called spheroidal condition of water on a hot iron depends for its exhibition on temperature of both water and iron. Very cold water may become spheroidal on polished iron at 215°. The phenomena becomes more effective at higher temperatures, and is worthy of study as exhibited in working large masses of iron with a wet hammer.

(23) M. E. R.—There are a variety of well pumps to be had through the hardware trade. We know of nothing better than oak for a chain pump box. Your tile drain should not be tolerated near a well. If the drain is necessary in its present position, it should be made of cast iron pipe with lead joints well tamped. There is no simple test for contamination in wells. Poisonous water often looks bright and clear.

(24) W. C. W. asks how the polished ironwork on a printing press can be restored to its former brightness after it has become rusty and black from oil. A. Scrape off the hard oil and clean with kerosene; then polish with fine emery paper. Parts that are rough from rust must be rubbed down with medium emery paper or cloth, then polished with fine emery paper.

(25) G. H. B. asks in what form to put zinc in order to secure the greatest movement of a rod (on the thumb wheel of a lamp) by the expansion of said zinc, to regulate an incubator lamp? A. Make a combination lever of sheet zinc and sheet iron, say of strips 1 inch wide No. 16, fastening each end together by riveting or soldering, and holding them together throughout their length by riveting or winding with twine. Fasten one end to the side or top of the incubator. The variations in temperature will swing the other end to operate a lever upon the rod. Strip should be from 18 inches to 2 feet long.

(26) J. E. E. asks: By what process is "graying" done—with acids—upon polished iron or steel, which is frequently preferred to "bluing"? A. By dipping or sprinkling with dilute nitric acid after heating until blue. 2. How to make a smelter for brazing iron or steel that will fuse at a lower degree than brass. A. By mixing a little more zinc or tin with the brass. Silver is better for steel solder.

(27) G. A. C. asks: 1. What is a good paint for steam pipes when exposed to a very high temperature? A. Finely pulverized plumbago and linseed oil is as durable as any. 2. What is used to mix gilt, gold, copper, etc., for painting steam heating apparatus? A. For ordinary bronzing, the metallic bronze powder is rubbed upon the paint when nearly dry, then varnished with thin mastic.

(28) L. B. asks (1) a process to soften cast iron boxes, to chamber them to receive babbitt. A. Only by long annealing in a charcoal fire and covering over the fire with hot ashes, leaving the boxes to cool gradually. 2. A recipe for cementing cast iron. A. See SCIENTIFIC AMERICAN, February 6, 1886, Cement for Cast Iron.

(29) E. S. asks: 1. Will a leather belt transmit as much power on rubber-covered pulleys as a rubber one? If not, about what is the difference? A. No; 50 per cent in favor of rubber belt on rubber pulley, when both are new. 2. What oil is best for a small lathe and like machinery? I have trouble with the oil gumming. A. Best cold pressed lard oil, with one-tenth kerosene.

(30) F. W. S. writes: The precession of the equinoxes, 20 minutes 20 seconds per year, will amount to one day in about 70 years. In that length of time from 1885 will they fall upon the 20th of the month instead of the 21st, as at present? A. 20 minutes 23 seconds is the true precession in time. This year the equinox occurred on the 20th at about 4:35 P. M. of the astronomical day, which is also 4:35 P. M. of the civil day. The equinox will enter the 19th day, civil time, in 49 years.

(31) J. H. B. asks: What size engine and boiler will run a boat 22 feet long, 5 feet beam, and 3 feet deep, at speed of 9 miles or more an hour? A. 3×4 cylinder; vertical boiler, 26 inches diameter, 45 inches high; 20 inch wheel, 36 inches pitch.

(32) C. M. asks: 1. What can be used to render new patches in an old brick wall similar in appearance to the old? A. We know of no means of accomplishing such result. 2. I have seen something like a charcoal stick, which when burning at one end would cut glass. What is its composition and how is it made? A. Take sticks of soft wood (willow or poplar) of about the thickness of a finger, which must be thoroughly dry, immerse for about a week in a concentrated solution of lead acetate and then dry. See also "Simple Method of Cutting Glass," in SCIENTIFIC AMERICAN for October 31, 1885, page 275.

(33) G. J. E. asks: How can I dilute crude carbolic acid with water? I have not been able to mix it thoroughly. A. Carbolic acid is soluble in 15 parts of water, therefore you cannot expect to make a very satisfactory solution except by using large quantities of water. Heat will facilitate the solution somewhat, but alcohol, ether, and acetic acid are the best solvents.

(34) J. B. W.—Pure water will not affect flues or boiler. If you are using a surface condenser, you are probably pumping oil into the boiler, which may contain acid that will act on the boiler. There is no acid from the brass tubes.

(35) D. & S.—Broken anthracite measures 45 cubic feet to a gross ton, or 50 pounds to the cubic foot, but the specific gravity of anthracite varies from 1·350 to 1·640, or from 84 to 102 pounds per solid cubic foot, so that there will be a variation of from 2 to 3 pounds to the cubic foot as above stated for various kinds of coal.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated.

O. H. J.—The specimen is a micaceous schist, partially decomposed, and of no value.

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For which Letters Patent of the United States were Granted

May 4, 1886,

AND EACH BEARING THAT DATE.

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