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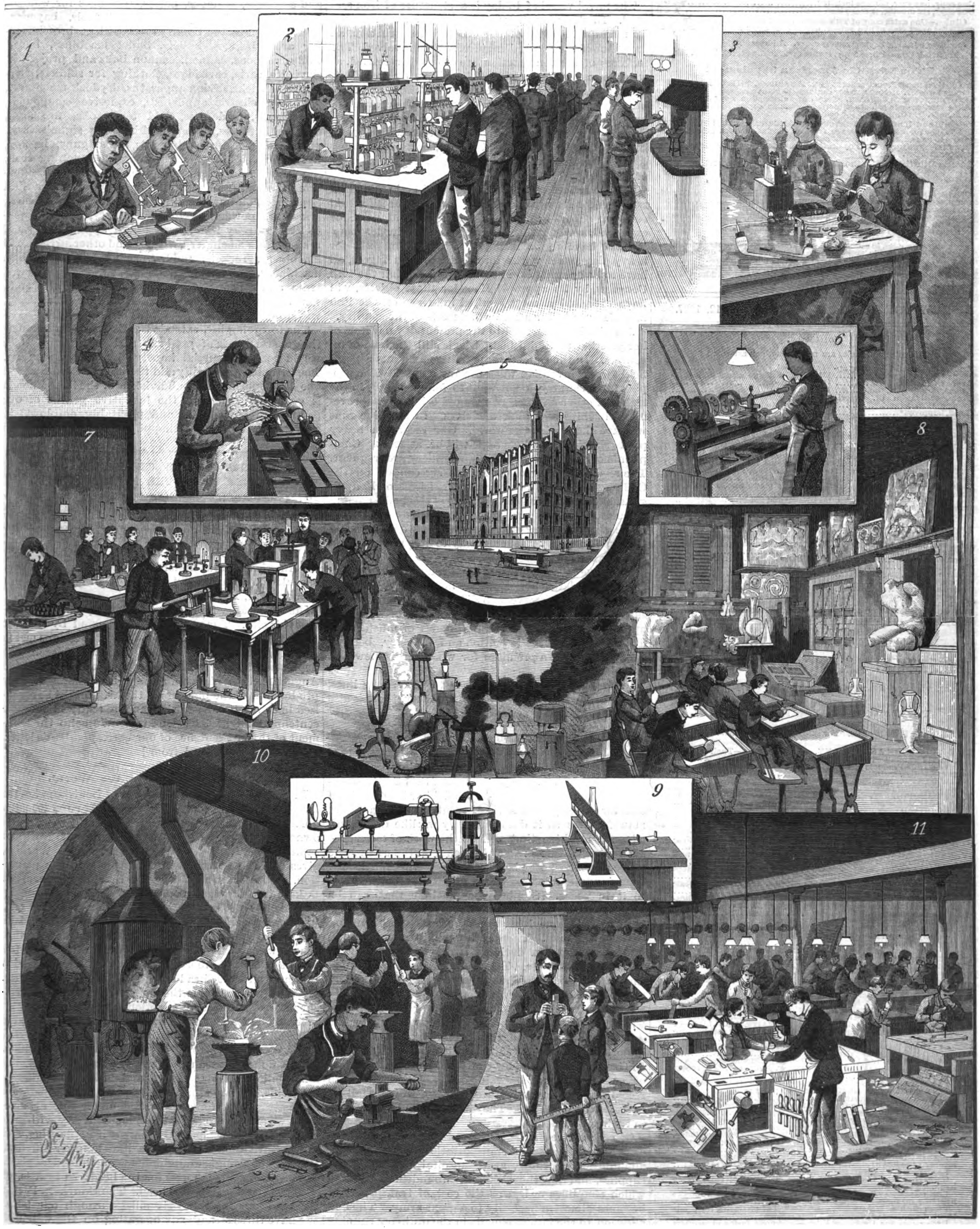

THE COLLEGE OF THE CITY OF NEW YORK—THE TECHNICAL COURSES.—[See p. 165.]

1. Microscopy. 2. Chemical Laboratory. 3. Blowpiping. 4. Wood Lathe. 5. View of College. 6. Iron Lathe. 7. Physical Laboratory. 8. Drawing Room. 9. Melloni's Apparatus. 10. Blacksmith Shop. 11. Carpenter Shop.

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NEW YORK, SATURDAY, MARCH 12, 1887.

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 584.

For the Week Ending March 12, 1887.

Price 10 cents. For sale by all newsdealers.

NEW NAVAL AND MILITARY INDUSTRIES.

The Congress which has just concluded its labors has been a notable one. The American navy has gradually gone on the downward path until the country is well nigh without defenses. The forts, while still maintained, are out of date, and the ordnance is far behind the age. The attention of the Senators and Representatives has at last been effectually aroused, and large appropriations, amounting to many millions of dollars, have been made for new works. It is yet too soon to know the exact amount, but enough has been designated to have a very great effect upon the industries of the country.

The naval vessel of to-day is a structure of iron and steel. In the generalities and details of the process of its manufacture and of the ultimate construction, all branches of mechanical engineering are involved. The features of the construction are no longer settled, as was the case with the old sailing ships, by precedent. The former navy was the creation of sailors and shipbuilders. The modern ships of war are the creation of inventors and of engineers. The same applies to ordnance. The successful originators of machine guns, breech loading cannon, and torpedoes must be unfettered by precedent. Originality must be the keynote of success.

This much refers to the product; but in the plant required for its production a great field for industrial enterprise is offered. For these appropriations to be expended, new plant of a type not existing in this country will have to be installed. New rolling mills for heavy plate, steel works for casting cannon ingots, all have to be organized. It seems probable that the 49th Congress, by its appropriations for these objects, will have exercised a most marked influence on the iron manufacture and mechanical interests of the country.

America has preserved to the present day one item of her prestige undiminished. She is still the land of inventors. In the expenditure of these amounts a great field for her inventive talent seems opened. The people of this country do not want to follow blindly in the tracks of other nations. We should originate improvements in ships and guns ourselves. In machine guns we have already led the world. Our record in heavy pieces should be, and we hope will be, as great. Complaints of the failures of foreign artillery are frequent. The recent bursting of an Armstrong cannon on the Collingwood, and more recent criticisms of Krupp's guns, show that perfection is not yet reached. Even in the material there may be a change. We are now the leading manufacturers of aluminum; we may yet be the first to apply it successfully to the manufacture of ordnance.

We have already taken the ground that America, from her isolated position, does not need the standing army and the reserve supplies that alarmists consider requisite. Yet in the expenditure of these new appropriations we can see a promise of much good. They will stimulate invention and industry, because the amounts are a premium for whatever is new and valuable.

In fortification, which now has to be on new lines, owing to the increased power of artillery, there is also a vast field for original work.

WAR AND INVENTION.

(*Concluded from page 33.*)

It will readily be perceived that war in European countries, where a very large percentage of the effective manhood of each nation is sent to the field or into garrison, calls for as many labor-saving inventions in the arts and manufactures as it does in purely warlike directions. Given a machine that will do the work of ten men—even though at no saving of expense on the cost of the manual labor whose place it takes—it will find in war time innumerable uses which might not be accorded to it in peace. Similarly, a machine that can be managed or tended by a woman will take precedence in war time of one doing the same work but requiring the care of a man. These facts should be remembered by inventors when deciding in what countries they will take out patents. They should also bear in mind that in Europe, while inventions which are wanted by the government—particularly those directly devoted to war purposes—may be appropriated to government use without the patentee's consent, it is customary for the government to reward the inventor according to the importance of the invention and the use made of it. In Great Britain it is now the practice for a board of officers to pass upon the value of the invention, and to recommend the amount of royal grant which shall be made to the patentee. They are not usually illiberal in their allowances.

Of course, one of the important requisites of a land campaign is an efficient transportation service for food, ammunition, clothing, arms, hospital stores, general supplies, and for the sick and wounded. Anything which simplifies or lessens the cost of transportation becomes almost a necessity to a great army. Thus, in addition to the improvements in the ordinary running gear of wagons and ambulances, the inventor has wide scope in steam motors capable of going anywhere over roads accessible to ordinary heavy vehicles. Even the shoes and harness of draught animals may afford opportunity for successful invention. Pontoon and other styles of bridges, suitable for rapid transportation in sections, or designed for construction from growing timber, would be generally used in a European war.

While it would probably be difficult to mention all the varieties of invention that would, or should, receive a special impetus from a great war, the following alphabetical list includes the greater number:

Accouterments, aerial machines, air-guns, alloys for gun metal, ambulances, ammunition, amputating instruments, anæsthetics, antiseptics, artificial limbs, armor for ships and forts, arms of all kinds, artillery and carriages, balloons, balsas, bandages for wounds, battery guns, battery forges and tools, bayonets, beacons, bombs and bomb proofs, boilers, breech-loading arms, bridges, bullets, bullet machines, buoys, cables, caissons, cannon, cannon balls and projectiles, carriages, carts, cartridges, clothing for soldiers, compasses, derricks, diving apparatus, drydock machinery, dynamos, electric appliances, explosive compounds, ferry boats, field guns, field telegraphs, fire arms, floating batteries, flying machines, fog signals, fuses, gun carriages, gun equipments, great guns, harness, hydraulic machinery, horse shoes, intrenching tools, life boats, lubricators, machine guns, magazine firearms, medical appliances, mining appliances, nautical appliances, oil-burning furnaces, ordnance, propellers, pontoons, powder-making machinery, primers, projectiles, railway rolling stock and appliances, rams, road-making machinery, reaping and other agricultural machinery, rockets, saddles, shells, splints, steam machinery, submarine appliances, surgical appliances, tents and fittings, tools, torpedoes, torpedo craft, tourniquets, well diggers, woodworking machinery, wrecking machinery.

The foregoing list, extended as it is, embraces only the general heads of products and machinery which would receive a special impetus by a European war. The inventor will readily add thereto the thousand and one developments and subdivisions of the list. Enough is given to show that the inventive genius of our people can be actively and profitably employed in case the great powers unhappily should prefer war to peace.

CELEBRATION OF THE CENTENNIAL OF THE ENACTMENT OF THE PATENT LAWS.

To the Editor of the Scientific American:

The first patent law was enacted in U. S. A. on the 10th of April, 1790. I would suggest that inventors meet in 1890 at some place for centennial celebration, for the purpose of showing the great progress made by the American genius under the protection of the law. I would like to hear from others. F. M. SHIELDS.

Coopwood, Miss.

[As the locality for such a convention, we would suggest this city. The patent law was passed by the first United States Congress, whose first two sessions met in New York, the first session lasting from March 4 to September 29, 1789, and the second from January 4 to August 12, 1790. An exhibition of inventions, of early productions of the pioneers of the arts, might be organized in connection therewith, and a really memorable centennial might be celebrated. We echo the sentiment of the last sentence of our correspondent's letter. Others should be heard from.]

The Largest Farm in the World.

In the extreme southwest corner of Louisiana lies the largest producing farm in the world. It runs 100 miles north and south, and many miles east and west, and is owned and operated by a syndicate of Northern capitalists. Their general manager, J. B. Watkins, gives an interesting account of this gigantic plantation, which throws the great Dalrymple farm in Dakota into the shade completely.

"The 1,500,000 acres of our tract," Mr. Watkins said, "was purchased in 1883 from the State of Louisiana and from the United States Government. At that time it was a vast grazing land for the cattle of the few dealers in the neighborhood. When I took possession I found over 30,000 head of half-wild horses and cattle. My work was to divide the immense tract into convenient pastures, establishing stations or ranches every six miles. The fencing alone cost in the neighborhood of $50,000. The land I found to be best adapted to rice, sugar, corn, and cotton. All our cultivating, ditching, etc., is done by steam power. We take a tract, say half a mile wide, for instance, and place an engine on each side. The engines are portable, and operate a cable attached to four plows, and under this arrangement we are able to plow thirty acres a day with only the labor of three men. Our harrowing, planting, and other cultivation is done in a like manner; in fact, there is not a single draught horse on the entire place. We have, of course, horses for the herders of cattle, of which we now have 16,000 head. The Southern Pacific Railroad runs for thirty-six miles through our farm. We have three steamboats operating on the waters of our own estate, upon which there are 300 miles of navigable waters. We have an ice house, a bank, a ship yard, and a rice mill."—*St. Louis Republican.*

Preserving Hides with Kieselguhr.

In the treatment of hides and skins with a view to preserve them from injury through rotting, maggots, and other products of decomposition, Mr. E. A. Brydges, of Berlin, proposes to treat them with kieselguhr or berghmehl, which corresponds to the fossil meal, diatomite, or infusorial earth of the English, and consists of the shells of minute animals of such extreme fineness that a cubic inch of fossil meal contains upward of forty thousand million shells. This fossil meal consists, chemically considered, of over 90 per cent of silicic acid and a small percentage of potash and organic matter, which latter can be removed by simple calcination, and is extraordinarily hygroscopic, being, in fact, capable of absorbing an enormous quantity of fluid. The invention of Mr. Brydges consists in a novel treatment or process of treating raw and other hides or skins prior to tanning, tawing, or other treatment, in order to free them from all fluid matter which could promote or assist putrefaction, and to deprive them of all nourishment for insects, which cause such enormous damage to hides and skins during transport. It may be mentioned that according to Berzelius this fluid matter composes two-thirds, while the fibers weigh only one-third of the entire hide.

The advantage of the kieselguhr is that, although it possesses the property of absorbing fluids and other matter in solution with great energy, it is not itself absorbed or in the least degree affected. Mr. Brydges employs the kieselguhr in various manners; for instance, he takes it as it leaves the mine, and simply dries it, or he calcines it, either exposed to the atmosphere or in closed retorts or other apparatus, so that the meal is carbonized. Both systems of calcining—that is to say, (a) exposed to atmospheric influence by calcining in the open air or in an ordinary calcining furnace; (b) by calcining in closed retorts or vessels—can be readily carried out, and will give excellent material for preserving hides. All organic matter having been removed, the absorbing power of the mineral is increased, but Mr. Brydges does not restrict himself to employing it calcined, as washed and dried or raw dried kieselguhr or fossil meal of any kind in a dry state can be employed; neither does he restrict himself to any special manner of treating the hides, as they can be manipulated in various ways without departing from the nature of the invention.

The hides for transport, or hides which are to be dried rapidly, are spread out on a layer of the mineral with the epidermis or the fleshy side downward, and are then covered with a second layer of the mineral. The hides, if not required for immediate transport, are allowed to lie for a time, and can, if desired, be subjected to pressure, although Mr. Brydges believes that this will seldom be found necessary or even advisable. It is, furthermore, advisable in the case of perfectly raw hides—that is, hides fresh from the carcasses—to replenish or change the layer or layers of the mineral, so as to facilitate the drying process. Hides for transport can also be rolled up or packed in kieselguhr, so as to protect them from all injury during the sea or other voyage, the weight of the mineral being so small that the freight difference will be of little or no importance. Spent kieselguhr can be rendered fit for re-employment by simply calcining it, so as to destroy any and all organic matter contained in or absorbed by it.

Great Pumps.

At a recent meeting of the Engineers' Club, Philadelphia, Mr. Henry R. Cornelius read a paper relating to the two large centrifugal pumps at Mare Island Navy Yard, California, built by the Southwark Foundry and Machine Company.

The pumps, the dimensions of which are 42 inch discharge pipes and 66 inch runners, are each driven direct by a vertical engine 28 inches diameter by 24 inches stroke, and were designed to remove the water from a dock 529 feet long, 122 feet wide, and 36 feet deep, with a capacity of 9,000,000 gallons.

After being erected on foundations prepared by the government, a test trial was made by a naval board, the following being extracts from their report:

At the final trial of the two pumps together, the water was admitted to the 23d altar, the dock containing 7,317,779 gallons, being 7 feet above the center of the pumps.

"Everything moved most admirably, and the performance of these immense machines was almost startling. By watching the water in the dock, it could be seen to lower bodily, and so rapidly that it could be detected by the eye without reference to any fixed point."

"The well which communicates with the suction tunnel was open, and the water would rise and fall, full of rapid swirls and eddies, though far above the entrance of these tunnels."

"Through the manhole in the discharge culvert the issuance from the pipes could be seen, and its volume was beyond conception." "It flowed rapidly through the culvert, and its outfall was a solid prism of water, the full size of the tunnel, projecting far into the river."

"During a pumping period of 55 minutes, the dock had been emptied from the 23d to 2 inches above the 6th altar, containing 6,210,698 gallons, an average throughout of 112,922 gallons per minute. At one time, when the revolutions were increased to 160 per minute, the discharge was 137,799 gallons per minute. This is almost a river, and is hardly conceivable."

"The engines worked noiselessly and without shock or labor. At no time during the trial was the throttle valve open more than ⅜ inch."

"The indicator cards taken at various intervals gave 796 horse power, and the revolutions did not exceed 160 at any time, though it was estimated that 900 horse power and 210 revolutions would be necessary to attain the requisite delivery, so that there is a large reserve of power available at any time."

"The erection of this massive machinery has been admirably done. All the parts are strong, and of excellent design and workmanship; simple, and without ornamentation."

"Looking down upon them from a level of the pump house gallery, they are impressive and massive in their simplicity."

"The government is well worthy of congratulation in possessing the largest pumping machinery of this type and of the greatest capacity in the world, and the contractors have reason to be proud of their work."

Photographs on Glass, Pottery, etc.

An improved process of producing photographs on pottery ware, glass, etc., known as a photo-ceramic process, has been patented by the Hon. Denis Lawless, of the Barracks, Aldershot, and a few notes concerning it may be of interest to your readers. The patentee says (I quote from his specification, which is No. 358, 1886):

"My invention relates to a photo-ceramic process for producing pictures, photographs, or other designs on tiles, plaques, or other objects of pottery ware, or on plates or other objects of glass, metal, or other similar substances, by impressing on them a raised and depressed surface corresponding to the lights and shades of the picture, photograph, or other design, by means of a die or mould into which, or with which, the clay, glass, metal, or other material used for making the object is pressed or moulded. The die or mould is made by casting in metal, or by electrotyping from a reverse mould, or it may be made in plaster, wax, gutta percha, or other material, the mould being taken from a 'gelatine relief,' or from a reverse mould thereof, or the 'gelatine relief' itself may be used direct for impressing the object with the raised and depressed surfaces. After the object has been moulded or impressed, it is glazed or enameled with a colored glaze, enamel, or other vitreous substance which is more or less transparent, and is then fired or heated to a temperature sufficient to melt the enamel, which then runs into the depressed parts of the object, which correspond to the darker or shaded parts of the picture or design, leaving the raised parts corresponding to the lighter parts, thus producing the original picture or design, with all its graduations of shade, in whatever color the glaze or enamel may be, if the body of the object is white, or modified, if it is colored, according to the color of the glaze or enamel. By the use of various colored enamels the picture or design on the object may be produced in colors. The 'gelatine relief' may be made according to Poitevin's process by allowing the light to act through a negative or positive transparency of the picture, photograph, or other design, or in some cases the picture or photographic print may itself be used as a transparency, on to a surface of bichromated gelatine of such a thickness as will be necessary for the amount of relief required. The bichromated gelatine is made by adding bichromate of potassium or ammonium to a warm solution of gelatine and afterward allowing it to set and dry on a level surface such as a glass plate, or the gelatine mass may be bichromated after it is set by soaking it in a solution of bichromate of potassium or ammonium. After the dried surface or film of bichromated gelatine has been sufficiently exposed to the light under the transparency of the picture or design, it is placed to soak in water, which causes those parts which have been protected from the light to swell up by absorbing the water, while those exposed to the light remain unswollen in a greater or less degree, according to the transparency or opaqueness of the various parts of the negative or positive transparency. The mould is then taken from the 'gelatine relief,' while the mass remains in a swollen condition. The 'gelatine relief' may also be produced according to the 'Stannotype' process by washing away in hot water those parts which have not been rendered insoluble by the action of light. In this case some pigment such as Indian ink should be added to the bichromated gelatine forming the surface or film. In making the bichromated gelatine mass, I find a suitable proportion of quantities to be ten grains of potassium or ammonium to one ounce of gelatine; or, instead of using only gelatine, I sometimes use a mixture of sugar and gelatine in the proportion of one part of sugar and eight parts of gelatine. In the application of the process to metals or other substances that can only be moulded in a molten condition or stamped or impressed under great pressure, I prefer to take an electrotype of the cast or mould from the 'first' or gelatine mould, and then proceed as hereinbefore set forth."

The patentee says that "he is aware that it is not new to produce 'first moulds' by the bichromatized gelatine process; neither is it new to glaze articles by dipping them in, or coating them with, glaze or enamel, and then firing them. But by the combination of these known processes, carried out in the manner described, he produces artistic results never before attained by a purely physical process.—*J. T. N., in Eng. Mech.*

Interference Plates for Photo Process Purposes.

In reply to inquiries where these plates may be obtained, one of our experts to whom we referred the matter gives the following information:

There are no perfect tints in the market that will do for the Meisenbach or interference process. Each individual who has worked the process in this country has had to either rule the plates for himself or else engage either a steel plate engraver or a metal ruler to rule the plates for him. The difficulty lies in the wearing of the cutting or the scraping tool. In engraving a ruled tint of, say, one hundred or one hundred and twenty lines to the inch, say ten inches square, one thousand lines or one thousand two hundred lines would have to be cut, or the equivalent of a line ten thousand inches long. Before the tool has traveled this distance, the sides of it are worn away so that the line cut is perceptibly narrower than on the start, and you have to suppose that no accident or clogging of the tool has occurred in this long journey. The same holds good in cutting through the most delicate friable ground on glass in order to obtain a direct negative. Another and just as important reason for not obtaining the desired result is the fact that the whole tint must be cut at one sitting without stop or rest, until the work is done. Any stop will show on the tint, especially a close one. The writer has spent some thousands of hours and of dollars in the attempt to get the desired result, and has never yet seen a perfect tint ten inches square of even one hundred lines to the inch, much less one hundred and twenty or one hundred and thirty lines. To accomplish the result, you must have, first, a perfect screw in your ruling machine, and a tool that will never wear out. When you get this, find, if you can, a metal that won't clog and a man that won't tire, and you can perhaps get your perfect results. On glass, you must have a composition that will neither clog the tool nor strip from the glass, and if you want to make a negative from a tint, and get one hundred and twenty lines to the inch from a printed tint, you will have to find some new means of printing the tints, to get them perfect enough to get the desired negative. This is not said to discourage the process people, who want perfect tints, but simply to explain why they are not in the market. You can of course get an approximate result, which is really all any of them get.

Treatment of Bright's Disease.

Semmola, of Naples, in an article in the *Wiener Medizinische Blatter*, No. 49, advises strongly against allowing a patient who is suffering from nephritis to come in contact with cold in any avoidable way. Such patients are excessively sensitive to cold, and cold baths are followed by great shock and depression. Violent massage and exercise of the muscles the author also strongly deprecates as followed by great shock and weakness.

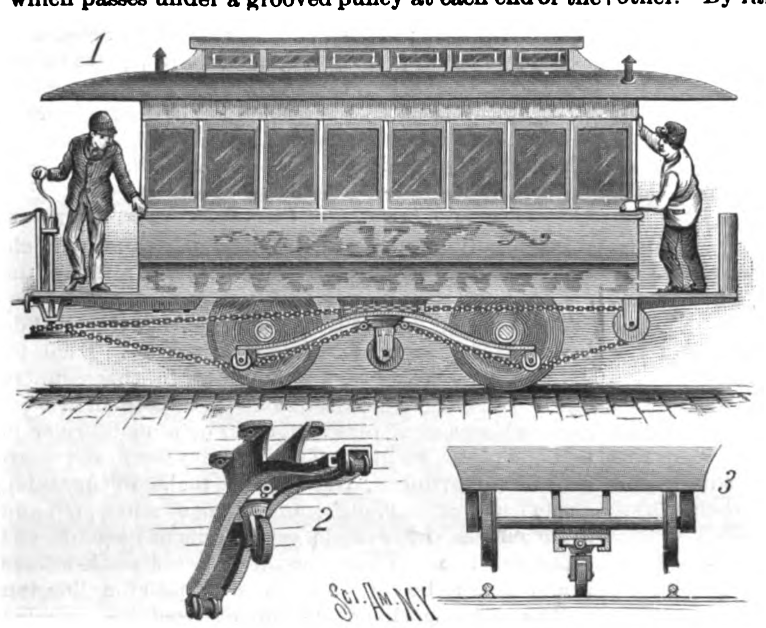
He would advise the patient to live in a dry and equable climate; to strictly avoid all exposure or going about in severe winter weather; to practice mild gymnastics in a comfortable room rather than venture into a temperature below 18° or 20° C. The author emphasizes the remarkable sensibility of the skin of the sufferer with Bright's disease to all variations of temperature. Sodium iodide and chloride is advised in doses as large as tolerated. When, after two or three weeks, albumen has not entirely disappeared and dropsy has been relieved, phosphates of sodium or calcium are given in quantities as large as 40 grains or a drachm daily. The efficacy of these drugs the author believes consists in their power to promote the assimilation of albumen.

The methodical inhalation of oxygen, which Semmola has urged since 1867, has been repeatedly proved to be of the highest benefit. Albumen soon disappears after its use, and although casts may remain in the urine, the patient's general condition is so much improved that the author thinks we have here an argument for the dyscrasic or hæmatogenic origin of Bright's disease.

All astringents are considered not only valueless, but also injurious. Especially is the action of ferrum sesquichloratum and plumbum aceticum thought injurious, because of their astringent influence on the capillaries of the skin.

DERAILING AND REPLACING ATTACHMENT FOR STREET CARS.

To the bottom of the car is secured a bracket, shown detached in Fig. 2, carrying a curved guide, which bends from the bracket downward and toward both ends of the car, passing below the axles. Mounted to slide in the guide is a crosshead, on which is centrally pivoted a forked arm, carrying on its lower end a wheel. Secured to the crosshead are the two ends of a chain, which passes under a grooved pulley at each end of the guide, around a pulley at one end of the car, and around a sprocket wheel attached to a turning shaft on the front platform of the car. When, for any reason, it is desirable to run the car off the track, the shaft is turned so as to slide the crosshead toward the front. This forward and downward motion of the crosshead brings its wheel in contact with the ground, and when the crosshead is in its lowest position, directly under the front axle, the car is raised and the front wheels are above the rails, as shown in the cross section, Fig. 3. The car may then be hauled off the track, either to the right or left. On account of its pivoted arm, the wheel turns in the direction in which the car is moving. The car can then be driven around an obstruction and brought upon the track again. As soon as the front wheels stand above the rails the shaft is turned in the opposite direction, to bring the crosshead back to the center of the car, thereby lowering the front end. By moving the crosshead to the rear end of the guide, the rear wheels of the car can be raised in a similar manner.

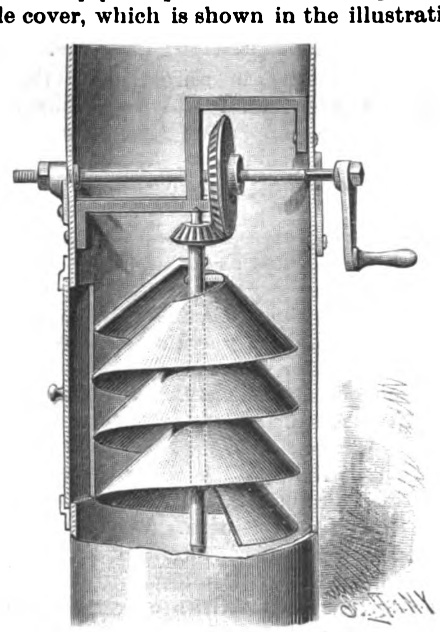


HENNIG & RETTIG'S DERAILING AND REPLACING ATTACHMENT FOR STREET CARS.

This invention has been patented by Messrs. Albert F. B. Hennig and Adam Rettig, whose address is 1314 Tenth Street, West Denver, Colo.

DAMPER FOR STOVE PIPES, CHIMNEYS, ETC.

The stove pipe is provided with an opening and a suitable cover, which is shown in the illustration as a slide working in guides. Within the pipe are placed two cross pieces, that form bearings for the tapered ends of a vertical rod provided with a series of laterally inclined arms, fastened to which is a plate which is wound around the rod so as to form a cone-shaped spiral nearly filling the interior of the pipe. The plate is so formed that when in position on the rod a central opening is provided which permits the exit of products of combustion. Upon the upper end of the rod is a small pinion engaging with a somewhat larger gear wheel mounted upon a shaft having bearings in the pipe. One end of the shaft is threaded to receive a nut and the other end is squared and receives a crank.



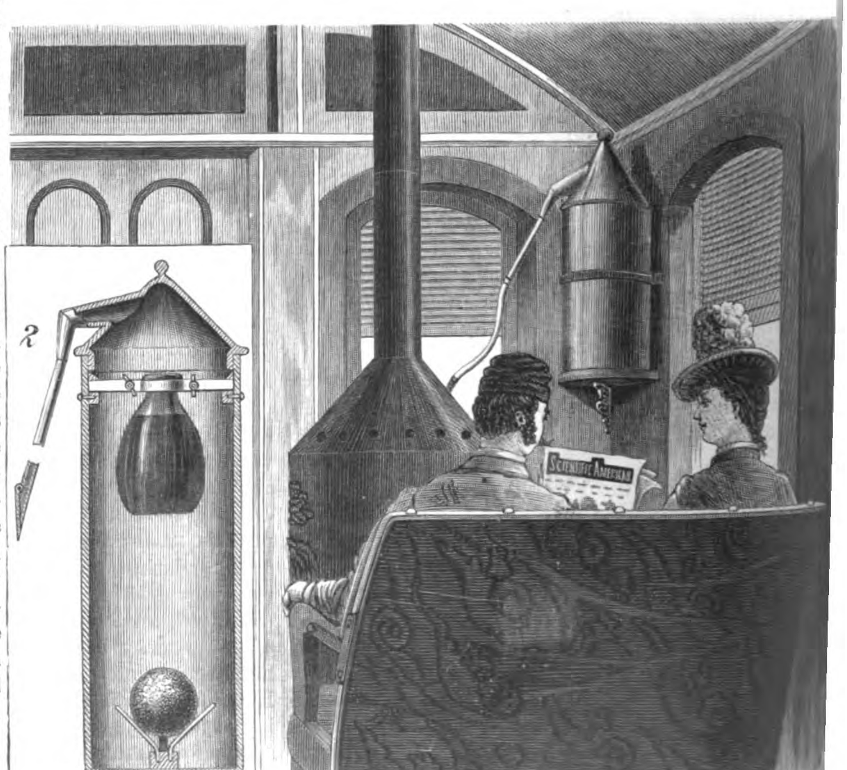
SOHN'S DAMPER FOR STOVE PIPES, CHIMNEYS, ETC.

The pipe is provided with two latches, one of which is formed with a recess to fit the squared end of the shaft, so that, when no movement of the damper is desired, this latch may be moved to engage its recess with the squared portion of the shaft, which will thereby be held. The other latch is designed to prevent lateral movement of the shaft by its free end dropping between the nut and face of the pipe. This latch also serves to keep the gear wheels in engagement with each other. By raising this latch, the shaft may be shifted, so as to separate the wheels, when the damper will be free to be revolved by the action of the heat and products of combustion passing through the pipe by the natural draught. In cases where insufficient draught exists in the chimney, the right hand latch is moved so as to free the shaft, while the left hand latch is placed in position to keep the gears in engagement. The shaft is then turned, causing the screw propeller to revolve rapidly, thus creating a suction and forcing the products of combustion quickly up out of the pipe, thereby increasing the draught of the chimney. To check the draught the parts are held stationary by the right hand latch, when the smoke will pass slowly up through the spiral. It is obvious that when the spiral is locked, the exit of the products of combustion will be checked in their passage through the screw, and, in consequence, much of the heat that is now carried up the pipe will be saved. When the screw is left free to rotate, it will still check the flow of the products of combustion, but in a less degree than when it is prevented from moving. The opening in the pipe is of such size as to admit of cleaning the screw and other parts should it become necessary.

This invention has been patented by Mr. Charles E. Sohn, of Hamilton, Ohio.

AUTOMATIC FIRE EXTINGUISHER.

This fire extinguisher is especially applicable for use with car heaters, and is designed, in the event of a collision or overturning of a car, to automatically extinguish any fire existing in the heater, and thereby prevent a conflagration. The cylindrical case shown in section in Fig. 2 is preferably made of brass, copper, or equivalent material, and upon the inside of the bottom is provided with four inclined rods forming a seat for a heavy metal ball. Held centrally in the top of the cylinder is a glass vessel made as thin as possible at the bottom. Screwing into and forming a cap for the cylinder is a conical top provided in one side with an outlet, over the outside of which a stout metallic tube is secured. The end of the tube is adapted to be inserted in the stove or heater above the fire pot, and is provided with an inclined surface having a hinged lid, the object of which is to prevent the heat passing up the tube. Between the pipe entering the heater and that portion connected to the cap is a flexible connection. The position of the stove, cylinder, and connecting tube is clearly shown in the perspective view. In operation, the cylinder is filled with a solution of carbonate of potash or soda, and the glass vessel with sulphuric acid. The cap is then screwed on and the extinguisher placed upon a bracket, a convenient distance from and above the stove, being held in position by a band or other appropriate means. The pipe connected with the cap is then carried downward through the stove, and its end held above the fire pot. In the event of a collision, or of the car being thrown upon its side, the heavy ball will strike and break the thin glass vessel, thereby liberating the sulphuric acid. The carbonic acid gas then generated will pass through the tube, spray over the heated fuel, and extinguish the fire. This fire extinguisher is the invention of Messrs. F. L. Hotchkin and P. A. Raby, of 423 Fulton St., Brooklyn, N. Y.

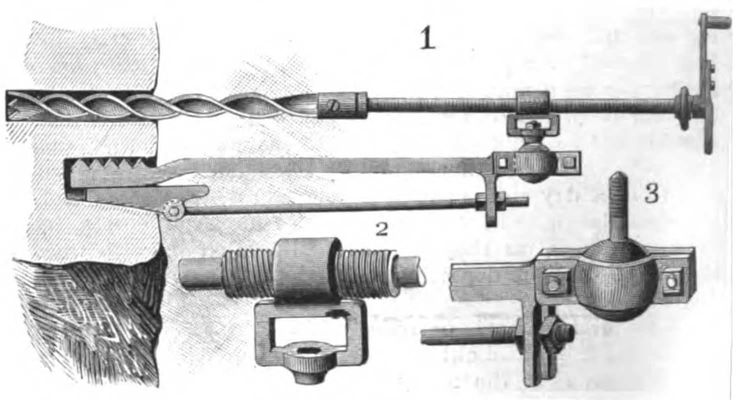


HOTCHKIN & RABY'S AUTOMATIC FIRE EXTINGUISHER.

THE Eastern standard is the official time in Maine.

IMPROVED COAL OR ROCK DRILL.

The forward end of the main bar or stock of the drill is provided with teeth adapted to be forced into the side of a hole made in the rock by a wedge driven into the hole. To the wedge is pivoted the end of a brace rod, the back end of which enters a slot made in a heavy lug formed on the main bar. The rear end of the rod is threaded to receive a pair of jam nuts, which after the wedge has been driven tightly in the hole will be screwed hard up to opposite faces of the lug, as shown in Figs. 1 and 3. The main bar will thus be stiffened or strengthened to give substantial support to the drill-operating mechanism which it carries, so that the drill will work with little or no vibration, and its operation be made more easy and effective than it otherwise would be. At the back end of the main bar is a semi-spherical socket, formed partly in the bar and partly in a plate held to the bar by bolts, and in this socket is fitted a ball bearing (Fig. 3), provided with a threaded stem passing through the lower end of a head piece (Fig. 2), and receiving a nut within a slot of the head piece, as shown in the engraving. The top of the head piece is threaded to receive a hollow screw feed bar, provided at its outer end with a hand wheel. The spindle of the drill is fitted to turn freely in the bar. The spindle head or socket, in which the drilling tool is held, abuts one end of the feed bar, and the hand crank, by which the drill is turned, abuts the other end of the feed bar. By turning the hand wheel one way the drill may be forced forward to cut deeper, and by turning it in the opposite direction, the tool may be withdrawn from the hole. The ball bearing may be turned in its socket to set the drill at any required angle, up or down, or to either side, as will be readily understood. The drilling tool is made with three cutting points or teeth. This assures quick cutting action, and as the twist of the body portion increases in pitch from the point to the heel, the tool is self-clearing, so that the cuttings will not bind or clog in the hole, but will be carried backward and discharged as fast as made, which insures the free and easy working of the tool to any required depth.



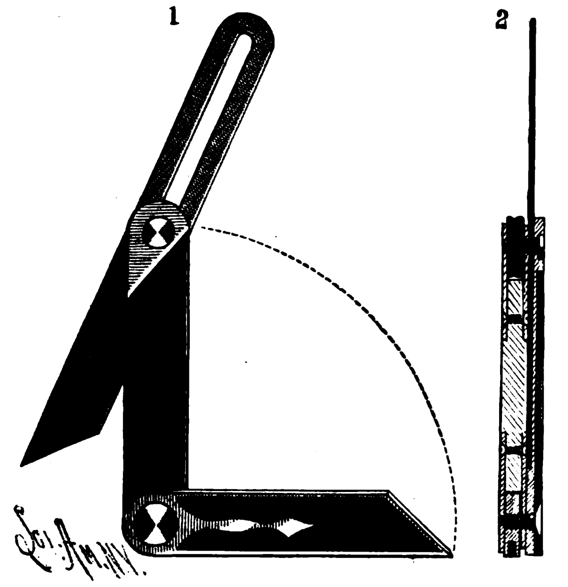
WILLIAMS' IMPROVED COAL OR ROCK DRILL.

This invention has been patented by Mr. John L. Williams, of Shenandoah, Pa.

THE plan of throwing a bridge over the Straits of Messina, that separate Sicily from Italy, will, when consummated, be one of the most striking feats of modern engineering. The place selected is where the channel is two and one-half miles wide and three hundred and sixty-one feet deep, and two piers will support a viaduct of steel rails to a height of three hundred and twenty-eight feet above the water.

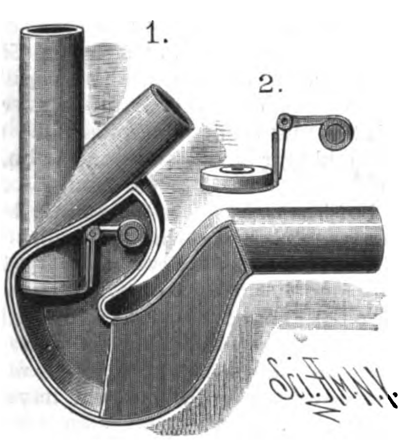
IMPROVED BEVEL.

Upon each side of the body at the ends is secured a brass plate having a circular projecting portion. The plates upon one side are formed with circular apertures centrally made in the projecting portions, while the plates upon the opposite side are formed with square



WITTER'S IMPROVED BEVEL.

apertures. Pivoted upon a screw bolt passing through these apertures are the two blades, shaped as shown in Fig. 1; Fig. 2 being a sectional view, showing the blades folded in suitable recesses provided in the body. Each bolt is provided with a circular thumb nut, having milled edges and a groove cut centrally around its edge to facilitate turning. The nuts may be further tightened by means of a nail set inserted in a hole made in their edges. The blades will be securely held in any desired position by these nuts. Near the pivotal point of the short blade, the top plate of the body is provided with gauge lines, to which the blade may be adjusted when it is desired to cut on a square or at an



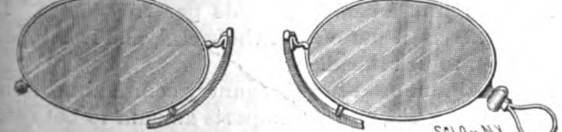
GERSTENBERG'S PLUMBER'S TRAP.

angle. The short blade is especially useful in working from plans, as both blade and handle are brought close thereto. Then, as the bevel is turned over to mark the wood, the thicker part of the handle is brought against the board to be cut. By the use of two blades in combination, almost angle may be obtained, and in cutting hips, valleys, and jack rafters the small top blade will be found especially useful. It will be seen that the means for tightening the blades are entirely out of the way, and not liable, therefore, to form an obstruction in handling the tool or become broken or disarranged from a fall.

This invention has been patented by Mr. Frank E. Witter, of Brooklyn, Conn.

IMPROVEMENT IN EYE GLASSES.

Ordinary eye glass frames, connected by means of the usual curved nose spring, can be adapted for use by different persons by springing the frame apart more or



IMPROVED EYE GLASSES.

less, but in so doing they are necessarily turned in their own planes, thereby rendering them useless for holding cylindrical lenses.

The annexed engraving shows a recently patented eye glass frame, in which the two lens-holding frames preserve their parallelism as they are separated or allowed to approach each other.

This invention consists in a pair of parallel bars attached to the lens-holding frames, each bar being provided with a loop for receiving the other bar, and a spiral spring surrounding one of the bars between the loops, and arranged to draw the lens-holding frames toward each other. This frame is especially adapted for holding cylindric lenses, such as are used by persons having astigmatic vision. It is of vital importance to mount such lenses so that their axes will preserve their parallelism when the eye glasses are adjusted to the nose. The improved frame accomplishes this result in a very simple and effective way.

While this frame is especially designed for mounting cylindrical lenses, it is not confined to that particular use, as it may be employed to advantage in mounting the ordinary spherical lenses.

Further information regarding this invention may be obtained by addressing Mr. J. B. Laurencot, 33 Maiden Lane, New York City.

How to Promote Health.

After all that has been stated of the effects of the atmosphere in high altitudes or at the level of the sea, the influence of forests and ocean, of sea coasts and interior places, humidity and dryness, cold and heat, the winds, electricity, and ozone, and no matter what of other conditions, the paramount considerations for the promotion of health are an *abundance of pure air and sunshine and out-door exercise.* Without these, no climate is promotive of health or propitious for the cure of disease; and with them, it is safe to say, the human powers of accommodation are such that it is difficult to distinguish the peculiarities of any climate by their joint results on the health and longevity of its subjects.—*Bell's "Climatology."*

PLUMBER'S TRAP.

The annexed engraving represents an improved plumber's trap, especially designed to prevent sewer gas from entering the house through the waste pipe. The horizontal waste pipe extends from one arm of the D-trap, while the vertical main outlet pipe enters the other arm. From near the end of the outlet pipe extends a branch overflow pipe. One side of the trap is closed by a plate which may be removed for clearing the trap or repairing the valve. The upper part of the trap, where it connects with the waste pipe, is on a higher level than the lower end of the outlet pipe, which is, therefore, always water sealed. The trap is formed with an upper chamber, within which the valve is placed. The valve proper, Fig. 2, is composed of a plate bent at right angles. Secured upon the upper surface of the lower portion is a packing of leather or other soft material to form a tight joint with the lower end of the outlet pipe when the valve is closed. The upper portion of the plate is connected to the lower arm of a bell crank, through the angle of which the valve is pivoted to a stud projecting from one side of the chamber. The other arm of the bell crank is provided with a weight which overbalances the lower part of the valve, so that the latter will close automatically when the water stops flowing from the main outlet or overflow pipe. Any gas that may find its way through the water retained in the trap will be prevented from entering the outlet pipe, and any pressure that might result from accumulated gas in the trap would only serve to force the valve more firmly against the end of the pipe.

All further particulars concerning the invention may be obtained from the patentee, Mr. F. C. Gerstenberg, of 1107 First Avenue, New York City.

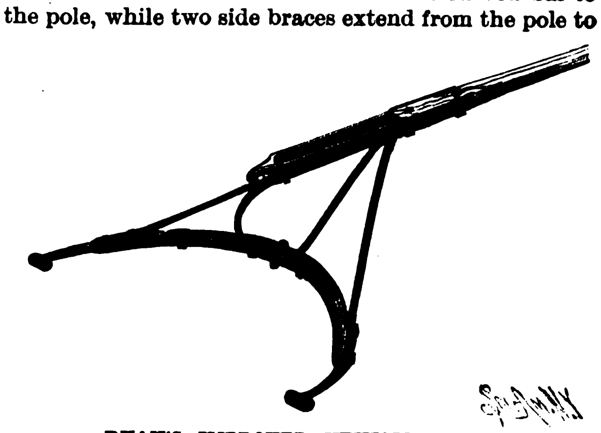
IMPROVED CASK OR TUB.

This invention is applicable to barrels or tubs in which the staves are formed with a groove to receive the heads, the object being to secure the heads against outward displacement, and to support the staves beyond the groove against any blow delivered upon the exterior of the staves that would tend to break off their ends. Secured within the staves, and outside of the head or bottom, is an angle iron hoop having one flange overlapping the head or bottom, and the other lapping the chine or projection of the staves and terminating at or near their ends, as shown in the accompanying cuts. The head or bottom is thus securely held in place, and the ends of the staves are sustained beyond the croze. Such a hoop of angle iron may be employed in connection with the outer hoop, which encircles the staves at their ends, and rivets common to both hoops may be inserted directly through the inner and outer hoop and the interposed staves. In connection with the hoop of angle iron as applied to the bottom of a tub, there may also be provided a second angle iron hoop, arranged upon the inner side of the bottom, and rivets may be passed directly through both the angle iron hoops, the outer hoops, and the staves, as shown in Fig. 3. By this construction the bottom is held both against downward pressure, which would result from the weight of the contents of the tub, and against any upward pressure or blow which would result from the tub being thrown upon a stone or other obstruction that would strike the bottom. This invention, without materially increasing the cost of manufacture of casks and tubs, adds greatly to their strength.

Further particulars may be obtained from the patentee, Mr. George R. Nafis, of 266 Monroe Street, Brooklyn, N. Y.

IMPROVED VEHICLE POLE.

The vehicle pole herewith represented is the invention of Mr. John J. Ryan, of Sardis, Miss. This pole is so designed as to permit of the use of a straight piece of timber in its construction in lieu of the ordinary curved pole, and which will allow hitching the horses nearer the vehicle. The curved bar is provided at its ends with pole couplings for attachment to the running gear. To the top of the center of the bar is secured a curved standard, the upper portion of which extends along the under side of the rear end of the pole. A brace rod extends from the center of the curved bar to the pole, while two side braces extend from the pole to

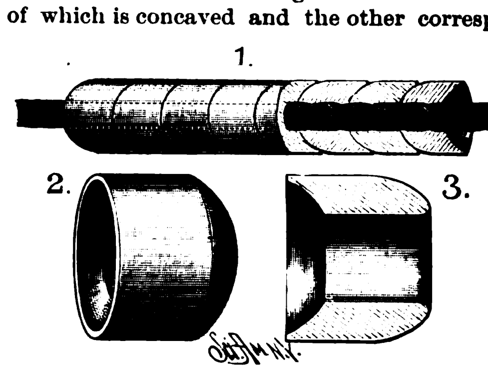


RYAN'S IMPROVED VEHICLE POLE.

the ends of the curved bar, the ends of these braces being extended sufficiently to form the pole couplings. The whiffletrees may be placed at the extreme rear end of the pole, if desirable, thus permitting of hitching the horses near the vehicle where they can pull to greater advantage, or the whiffletrees may be secured by passing the bolt through any one of the series of holes formed in the rear end of the pole.

COVERING FOR TRACTION CABLES.

This covering is designed to protect the cables and car grips from the extreme wear to which they are at present subjected, while it will in nowise impair either the flexibility or efficiency of the cable. On the cable is strung an endless series of tubular sections—one of which is shown detached in Figs. 2 and 3—one end of each of which is concaved and the other correspond-



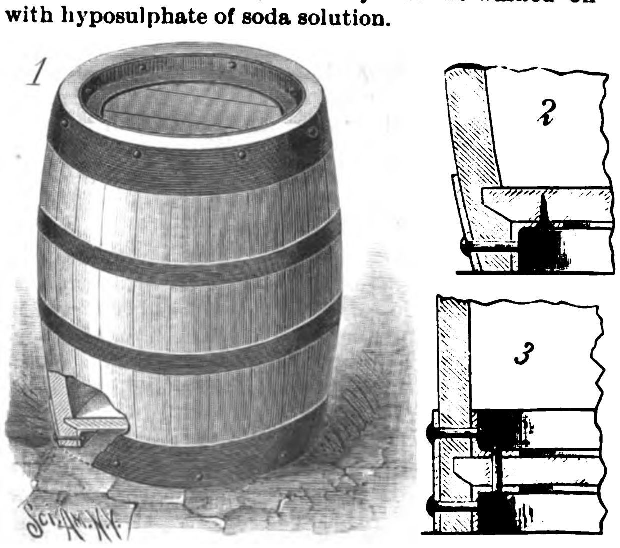
McCANN'S COVERING FOR TRACTION CABLES.

ingly convexed. The convexed end of each section fits closely and smoothly in the concave end of the next succeeding one, so that a ball and socket or universal joint is formed between each pair of sections. The sections are preferably made of cast metal, as iron, but may be of any other material capable of withstanding the great wear. They are strung closely on the cable, and at the splice may either be made in halves, secured together, or they may be formed by pouring melted metal into suitable moulds surrounding the cable. A continuous flexible covering is thus formed, which will receive the wear now falling on the cable strands.

This invention has been patented by Mr. Thomas E. McCann, of 1631 Catharine Street, Philadelphia, Pa.

Nitrate of Silver Stains.

Dip the fingers into a strong solution of cupric chloride. In about a minute the silver will be converted into a chloride, and may then be washed off with hyposulphate of soda solution.



NAFIS' IMPROVED CASK OR TUB.

DECISION RELATING TO PATENTS.

U. S. Circuit Court.—District of Maine.

WILLARD *et al.* *v.* COOPER. SAME *v.* THOMES.

PATENT FISHING APPARATUS.

COLT, *J.*:

In these suits the respondents are charged with infringing letters patent No. 240,630, granted to Henry E. Willard, April 26, 1881, for improvement in fishing apparatus. The object of the improvement is to provide a pocket or bag into which the fish, which have been caught in a seine, may be transferred and kept alive until they are dressed for packing. The apparatus consists of a pocket attached to the vessel's rail, and hung upon two booms which project from the side of the vessel. The booms are attached to the hull of the vessel, so as to move freely in different directions. There are guys at the outer ends of the booms, which serve to adjust them in a lateral direction, while they are raised and lowered by means of tackle extending from the masts to their outer ends. Outhauls connected with the outer corners of the bag serve to lower and raise the outer edge of the bag. Lace lines are permanently attached to the center of the head line, and run each way through grommets which are fastened to the head line. There are supporting lines connected with the center of the bag's head line, which are of use when the vessel rolls heavily. The seine is brought alongside the pocket by the seine boat. The outer edge of the seine is then fastened to the edge of the bag along the whole front of the bag, between the outer ends of the booms. This is done by thrusting the corks of the seine between the lace lines and the head line and then pulling the lace lines taut. The claim is for the pocket in combination with the seine, lace lines, grommets, outhauls, booms, head line, corks, supporters, and guys.

The defendants introduce a prior patent, granted to Benjamin Merritt, Jr., in 1858, which shows a net for catching fish attached to the side of a vessel, and stretched out upon two movable booms projecting from the vessel. Numerous witnesses are called who testify to the use of fish pockets with and without booms in connection with a seine prior to Willard's device. Many of these witnesses are not wholly disinterested, and for this reason this evidence is not entitled to the weight it would otherwise have; but, while receiving this evidence with caution, still, in view of what was manifestly old and well known, we cannot discover more than the exercise of mechanical skill in the construction of the Willard apparatus. We can find no invention in combining a fish pocket with a seine in the manner described, nor in the use of booms which are attached to the vessel in the same way as the old boat's boom, nor in the use of guys, head lines, grommets, and other well-known apparatus. In making and working a fish pocket, it seems to us these old and familiar things would immediately suggest themselves to one skilled in the art. In our opinion, Willard made no invention or discovery, in the sense of the patent law, such as entitles him to a monopoly, and therefore the bill must be dismissed.

Steam Torpedoes.

There is at the present time undergoing consideration by the British Admiralty authorities a system of propelling traveling torpedoes by means of steam instead of by compressed air, devised by Mr. Edward C. Peck, who is engaged in the constructive department of Messrs. Yarrow & Co.'s torpedo boat yard at Poplar. The torpedo is of the usual Admiralty pattern outside, the dimensions being 14 ft. long by 14 in. diameter, and it will carry in the forward part an explosive charge of 100 lb. of gun-cotton, together with the firing apparatus. The shell will be constructed of metal, and will be sufficiently strong to resist the external pressure of the water and atmosphere when a vacuum is formed within it. At about the center is a hot water reservoir, 4 ft. long and 11½ in. internal diameter, and capable of withstanding a given pressure. This reservoir will be surrounded by a coating of non-conducting material, three-fourths inch thick, and between the outside of this and the skin of the torpedo will be a space of three-eighths inch.

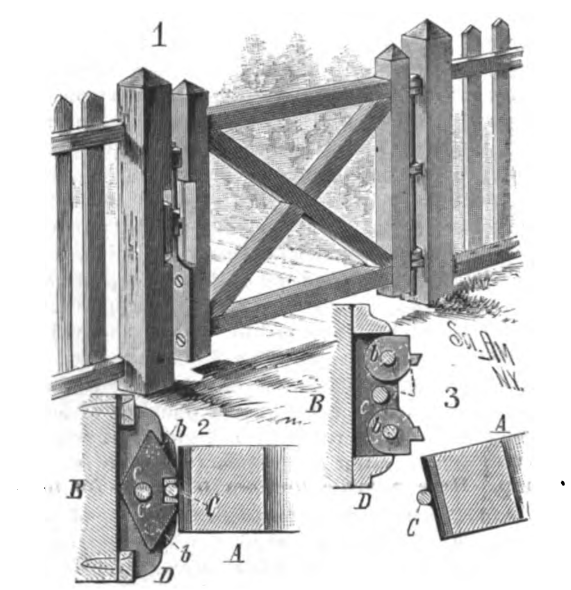
The reservoir is to be charged with about 160 lb. of hot water, taken from the main boiler of the torpedo boat or other vessel from which the weapon is to be discharged. The water will be transferred very rapidly, at a pressure of about 400 lb. per square inch, by means of a tube fitted with the necessary inlet and outlet valves, and there will be means for raising the temperature of the water, if necessary, during its transfer from the boiler of the boat to the reservoir of the torpedo. The charging operation will not occupy more than half a minute, and it is calculated that the torpedo will keep steam at the pressure necessary for driving her engines for at least an hour after it has been charged. The quantity of water carried will possess sufficient sensible heat to supply the propelling engines with steam of a slowly decreasing pressure during the run of the torpedo. The space between the reservoir and the skin of the torpedo, as also a portion of the space in the body of the torpedo not otherwise occupied, is utilized as a surface condenser for the steam after it has done its work in the engines. By this means the weight of the torpedo will be precisely the same at the close as at the commencement of the run. The torpedo will be fitted with engines of 60 horse power indicated, and capable of propelling it through the water at a speed of 32 knots an hour. It will be fitted with the usual fins, rudders, and regulating apparatus, to insure its traveling at any required depth and in any desired direction.

The advantages of a steam-driven torpedo would appear to be very considerable. In the first place, weight is saved in the torpedo itself, and the pressure being only about one-fourth of that in the Whitehead torpedo, using compressed air, there will be no difficulty in keeping all the joints and connections tight. In the next place, compressed air will only give a three-quarter minute run, while it is calculated that steam will give a run of a minute and three-quarters. The speed with compressed air is 24 knots, and the average range 600 yards, while with steam Mr. Peck reckons on a speed of 32 knots and a range of 1,800 yards.

IMPROVED GATE LATCH.

The gate is hinged in the usual way, and is provided with a latch rod, which engages with the latch, shown in detail in the sectional plan views, Figs. 2 and 3, secured to the post. The latch, D, is composed of a frame, tumblers, *b*, pivoted in a chamber of the frame, and the plate, *c*, pivoted to the frame on the pin, *c'*. The tumblers are nearly circular in form, and each is formed with a projection and straight shoulder, the latter serving as a stop to strike the frame and prevent the tumbler from swinging outward too far—that is, beyond the point at which the projection stands in the path of the latch rod to act as a stop to the gate, A, when the latter is closed. The front edge of the plate, *c*, is notched to form two projections, between which the gate rod, C, stands when the gate is closed. The outer ends of the plate are beveled, so that the rod will strike these edges when the gate is closed, and swing the plate back to permit the rod to pass the projection. By this arrangement the gate may be locked from either direction by turning one or the other of the tumblers to the position shown in full lines in Fig. 3. The latch rod has a spring action, so that it will pass the tumbler, which it strikes in closing the gate and swings to the position shown in Fig. 2, so that the gate will not open of its own accord. In pushing the gate open, the rod strikes the shoulder of one tumbler and swings it to the position indicated in Fig. 3. This action moves the rod inward, and causes it to pass the tumbler without friction.

This invention has been patented by Mr. Samuel Pugsley, of New Rochelle, N. Y.



PUGSLEY'S IMPROVED GATE LATCH.

Progress of Electric Lighting.

When the last census was taken, to wit, in 1880, the census man did not consider the electric lighting investment of sufficient importance to warrant him in collecting the data. Capital was at that time in a condition which might be called undecided, so far as the electric lighting field was concerned. The great promise that had been made for electric lighting by ill-advised persons had not then been realized, and the difficulties in the way—difficulties which, it should be said, always array themselves in the path of novel enterprises—seemed to present an insuperable barrier to the development which, at that time, was thoughtlessly promised and is now being realized. We say thoughtlessly promised because, while such development was not an impossibility in the future, the claims that were made of immediate profits were absurd, and investors unfamiliar with the field and its possibilities, who had been encouraged by these rash promises to come in, were soon stampeded.

But there were men with brains, as well as capital, in the electric light business. It was enough for them that the prospects were bright, without that they got an immediate profit. The demand for the light increased as the apparatus for its distribution was perfected, and as improvement was constant, the business grew. At first, as we have said, it was slow, then faster, until finally it sprang into public favor at a bound, and is now recognized as one of the best paying industries. We say that its rise and progress have been phenomenal, and if any one doubts it let him study the following figures, which we have carefully collected from the best known sources, and are approximately correct:

Amount of investment in voltaic arc plants in the United States on Nov. 1, 1886	$37,000,000
Incandescent plant	15,000,000
Investment by manufacturers of arc and incandescent plants	20,000,000
Invested in manufacturing other apparatus connected with electric light apparatus, including conduits, cables, etc.	15,000,000
Invested in the manufacture of carbons, about	5,000,000
Estimate of the value of patents, as made at the Patent Office by experts	15,000,000
Total	$107,000,000

And how long has it taken for this vast sum to be attracted to the electric lighting field? Only six years! Looking at the rate of progress, we find that from 1881 to 1882 the business of supplying electric light almost doubled, and has doubled year by year ever since. It cannot, of course, go on at any such rate as this much longer, for, as we know, the doubling process, if continued, mounts soon into infinity.

We find that there are over 650 local electric lighting companies in the country to-day.

We have been to no little pains to collect data looking to a reliable estimate of the number of arc lights now aglow in the country, because so many conjectures have been made and so much haphazard guesses indulged in. This has not been an easy task, because of the disinclination of some of the arc companies to give their returns. From this survey we discover that at least 125,000 voltaic arc lights are now lighted nightly—a very pretty showing truly!

In the incandescence field, a careful estimate, throwing out all figures of projected installations and sticking closely to what is really being accomplished to-day, we find that there are about 640,000 and some odd incandescence lamps aglow to-day in the United States.

The question as to electric lighting popularity has always been one of economy. No one ever doubted that electric lighting would be popular, but many did doubt if it would ever be cheap enough to be generally used. Happily, the cost of distribution, the cost of apparatus and of lamps, has become less and less yearly, indeed, we were about to say monthly, for those who are watching the movement have been surprised to see how quickly one improvement has to give way to another. To-day the cost of an electric lighting plant is less than one-half what it was six years ago, and there is every reason to believe that six years from now almost an equal decrease in cost will have been attained.—*Electrical Review.*

Platinum Ores.

The importers' price for refined platinum has risen steadily since 1883, when it was $6.50 to $7.50 per ounce, according to quantity bought. It is now worth $7.50 to $8.50.

The most important sources of platinum are the hydraulic mines at Nizhne-Taglsk and Forgo-Blagodat, in the Ural Mountains. About 80 per cent of the world's production comes from this source. Next in importance are the gold washings of the Pinto, in the United States of Colombia. About 15 per cent of the entire product comes from this source. It is also found in Brazil, Borneo, Hayti, Peru, India, Australia, and in the sands of the Chaudiere River, in Quebec. It has recently been found in a quartz vein in New Zealand. The interest in the deposit lies in the fact of the extreme variety of platinum in place.

Platinum has been found in small quantities in various parts of this country, associated with free gold in placer deposits, but it is only from the placers of California that it has been produced in merchantable quantity, which amounts to between 100 and 200 ounces per annum, and is sold at 75 cents per troy ounce. It contains about 85 per cent of the metal, and is shipped to London to be refined.

The platinum used in this country comes almost entirely from Russia, and the imports amount to between 2,000 and 3,000 pounds annually.

Platinum "ore," as it is called, contains iridium, rhodium, gold, copper, and iron. It is sometimes, though seldom, found crystallized in cubes and octahedrons, but more usually in rounded or flattened grains, or "sand," having a metallic luster. It is very rarely found in place, but mixed with placer gold sands.

The principal consumption of platinum is in the manufacture of chemical apparatus, but within the past few years the use of incandescent electric lights, and also gas-jets made luminous by a heated platinum spiral, have caused an increased demand for the metal, and the steady rise in price during the past three years may be referred to this cause.—*Georgetown Courier.*

THE COLLEGE OF THE CITY OF NEW YORK—THE TECHNICAL COURSE.

The tendency of modern educators is every day more directed in the way of manual training. The first steps in children's education by the kindergarten method of Froebel, and the followers and amplifiers of his system, consist in a training of the faculties of observation and manual accomplishment. It is claimed that by this system a child need only commence to learn to read when seven or eight years of age, and that, owing to his kindergarten training, he will pass by one who may have learned reading several years earlier, but who never had a regular course of object lessons. The object system being established as a foundation for educational training, the extension of the same system to the higher courses seems only logical. A strong movement to effect this has become prominent here and in other cities during the past year. In New York the project of establishing such classes in the public schools has been successfully carried out. Considerable notice has been taken of the attempts. The work of the students has been publicly exhibited, and commented on in the papers. While this has been going on in the grammar schools, and before this period, the College of the City of New York has unobtrusively, and without attracting any notice, carried out a similar advance. Manual and technical education is firmly established there. From blacksmithing and carpentry up to chemistry and physics, the leading branches of technical training have a place in the course.

The president of the college, General Alexander H. Webb, saw from an early period the necessity in a college course of making men think for themselves. Thus, to render the lectures in ancient art and history concrete, reference could be made by the professor to the college collection of pictures and models. If the Venus Victrix or Apollo Belvedere was spoken of, a picture or cast of the statue was at hand for illustration. Athens and its Acropolis became more than names when the views of the city and its buildings were presented to the student. The courses in chemistry and physics, from the beginning of the college, were profusely illustrated by the experiments of Professor Doremus, who, in his reputation of a demonstrator, is without rival in this country. Thus the eye has always been appealed to as well as the purely intellectual faculties, and this was the beginning of the advance. Within a few years the practical lessons of the laboratory, workshop, and drawing room have been added and made a part of the course. Some views of these are given in our illustrations.

The main college building is familiar to all residents of our city. It is situated on the southeast corner of Lexington Avenue and 23d Street. South of it a new building, devoted principally to the natural history department, was erected some years ago, and more recently a building devoted to the technical work of the students was erected to the east of the main building. These new departments are the ones illustrated in this issue.

Recognizing the practical, every-day importance of the microscope, the students are instructed in its use. The substances examined by it are principally commercial products. The obvious intention is to give the students a lesson that may be of service in business life, where these products are dealt in. The same is to be said for the blowpipe class, where mineralogy and examination of ores is studied. The construction of the blowpipe from a clay pipe, a cork, and a bit of glass tube will be familiar to some, but probably new to the greater number of our readers. These branches are in the charge of Prof. William Stratford.

For the study of practical and analytical chemistry a laboratory that in many respects is superior to any in the city is provided. The ceiling is very high, and rises in a series of parallel gables running east and west and glazed upon the north slope. These act as a series of skylights, admitting the north light only, and excluding all direct sun light. The effect is the most perfect illumination for work. The room is filled with laboratory tables, each table having its own set of reagent bottles, with name and symbol blown upon the glass of each. At the end of the room is an elevated platform, with lecture table and blackboard, for the use of the professor or instructor in charge of the laboratory. Various details about the desks are worthy of notice. No separate funnel or filtering stands are used, a series of sockets being provided that hold movable supports for the funnel. For every four desks a sink and water faucets are supplied, a distinct advance upon the old system of a single sink for a whole laboratory. Qualitative analysis is taught here; quantitative analysis as yet being given to but few of the students. Balances are, however, provided, so that the laboratory is equipped for both classes of work.

Physical science, as a rule more quickly appreciated by students than chemistry, is practically studied in laboratories devoted to it. Air pumps, gas analysis apparatus, electrical apparatus, gasometers, apparatus for illustration of heat and light, are here all used and handled by the students themselves. Radiant energy is worked at by sections of four or five students at a time with Melloni's classic apparatus. Those who have attended a good course of lectures in physics may form some idea of the work when it is stated that practically the students themselves repeat all the experiments incident to such a course.

Prof. Doremus, in whose charge these two departments are, lectures on the subjects of chemistry and physics, with all the illustrations the college's collections afford. His lecture room, as not appertaining to the students' personal work, is not shown. It is provided with every imaginable appliance, including the great air pump driven by steam.

The practical division, including the laboratories, is directed by Dr. Charles A. Doremus, together with Dr. L. H. Friedburg. The work of inspiring an army of students day in and day out with the magnetism necessary for their work is a most trying one, as any educator can testify. Upon the work of the laboratories, and upon this inspiration the success of the course depends.

The instruction in drawing on the blackboard, and on paper from relief models, and from memory, is a necessary feature of the programme. Besides relief models, natural history is made to supply subjects. On the boards the structure of mollusks and other types are drawn. In this way the art may be made the exponent of a branch of natural history, and by such reference acquire a new spirit of life and reality.

What we have thus far described is the work in the natural sciences. Practical and useful though the design is, a more striking, because on its face a lower and more every day, form of manual training is next to be considered. In an extensive workshop, wood and metal working are thoroughly taught. Some of the scenes are illustrated.

The treatment of iron begins with forging. The general principles of the art are given by the instructor, with blackboard illustrations. The students then don their aprons, light up their own fires, and in groups work at the assigned tasks. A number of portable forges with hand blowers keep all the students at work. On the occasion of our visit, all the class were occupied chain making. Another day, some other piece of forging would be executed. In this way a knowledge of this most artistic work is acquired. In no art can effects more characteristic of the pure work of the hand be produced. The achievements of the old time blacksmiths in decorative forgings can stand comparison with the work of any artificers.

The blacksmith shop is next to the lathe or turning shop. Here a large number of lathes for metal turning, both speed and engine lathes, are in daily use. Having learned how to forge his material, and acquired some idea of vise work, filing, etc., the final work of turning is taught. From our illustrations, owing to limited space, only an imperfect idea of the number of lathes and completeness of the equipment can be obtained. Between the lathe shop and blacksmith shop is an electric plant for supplying electricity for the general needs of the scientific department.

Next to the metal turning lathes come the wood lathes. There are about the same number of these. The students who have gone through the carpenter shop, and have learned joinery, are ready for wood turning. All the lathes are driven by power.

Finally, the carpenter shop is shown. A number of complete benches, with full outfit of tools, give every facility for good work. In this connection the subject of sharp tools is not lost sight of. The students receive special instruction in sharpening their saws, plane irons, etc. For the lessons in saw filing, strips of brass are supplied, which the student files into teeth for practice. This economizes material, and really affords, if anything, a better substance for a criterion of the student's work. The making of the different joints, such as mortise and tenon and dovetail, with other points in carpentry, are features of this course.

Thus it will be seen that the city of New York affords to the sons of her citizens a complete technical training free of all expense. With great judgment the students are not restricted to the regular hours for work in the shops. Late in the afternoon they may be seen bending over the lathes, or carpentering, or doing some other class of work. Yet we believe we risk little in saying that we are disclosing what is to many a new fact—the existence of such an opportunity for the poorest as well as the richest of the city's future citizens. The work of the college has been done so quietly and unostentatiously that less is known of it than should be.

The Shrinkage of Flannel.

To keep flannels as much as possible from shrinking and felting, the following is to be recommended: Dissolve one ounce of potash in a bucket of water, and leave the fabric in it for twelve hours. Next warm the water, with the fabric in it, and wash without rubbing, also draw through repeatedly. Next immerse the flannel in another liquid containing one spoonful of wheat flour to one bucket of water, and wash in a similar manner. Thus treated, the flannel becomes nice and clean, has barely shrunk, and almost not at all felted.

Correspondence.

The Army Comparison.

To the Editor of the Scientific American:

Your item copied from the *Sun*

French army, peace footing	523,000
German army, peace footing	445,000
United States Army of pensioners	400,000

conveys a false impression, which I believe you are willing to correct. The pensioner is only *partly* supported by the government. The pay and allowances of a soldier are several times as much as the average pension. For instance, a captain's pay and allowances are about $140 a month. His pension varies from $5 to $20, according to the degree of disability.

S. N. STEWART.

Philadelphia, Pa., February 26, 1887.

Experiments in the Cultivation of Beets.

Prof. D. G. Marck, of the University of Koenigsberg, has for several years been making an interesting series of studies upon the influence exerted by orientation in the cultivation of various plants, especially beets. He finds that, according as the lines are parallel with or at right angles to a north-south direction, the yield in quantity and weight show notable differences. We shall confine ourselves to a citation of the principal results as given in the very long and detailed report published by the performer of these interesting experiments.

If we suppose the weight of a beet deprived of leaves to be 16 ounces, and that of the collar and leaves to be eight, the difference in weight of the beets sown in the north-south direction, as compared with the east-west, amounts to +2·96 per cent for the weight of the roots and −8·44 per cent for that of the leaves.

Supposing a crop of 33,000 lb. of roots and 16,500 of leaves per acre, these differences are equivalent to +1,080 lb. of roots and −1,418 lb. of leaves and collars.

As regards polarization, the north-south lines always exhibit the highest figures, the surplus fluctuating between +0·16 and 1·33, and the average being 0·48 per cent.

It may be conceded that the north-south lines yield the most saccharine beets. As regards the quotient of purity, the greatest purity was, except in one case, obtained in the north-south lines, the quotient fluctuating between −1·20 and +4·33 per cent. It may be concluded, then, that the north-south lines furnish the purest beets. If, therefore, concludes Prof. Marck, two sowings of beets are cultivated under the same conditions, with the lines oriented in contrary directions—north-south and east-west—the north-south lines will yield a crop which is superior as regards weight of roots, saccharine richness, and purity, but will furnish a less quantity of leaves.

Prof. Marck explains these differences as due to the unequal action of the solar light and heat. They are more sensible where the beets are cultivated in ridges or shelving beds than they are where the culture is in even ground. When the lines run north and south, the surface looking toward the east receives the solar rays in the morning, while the one turned toward the west receives them in the afternoon, and the absorption of heat is greater than when the direction of the lines is parallel with the east-west direction.—*La Nature.*

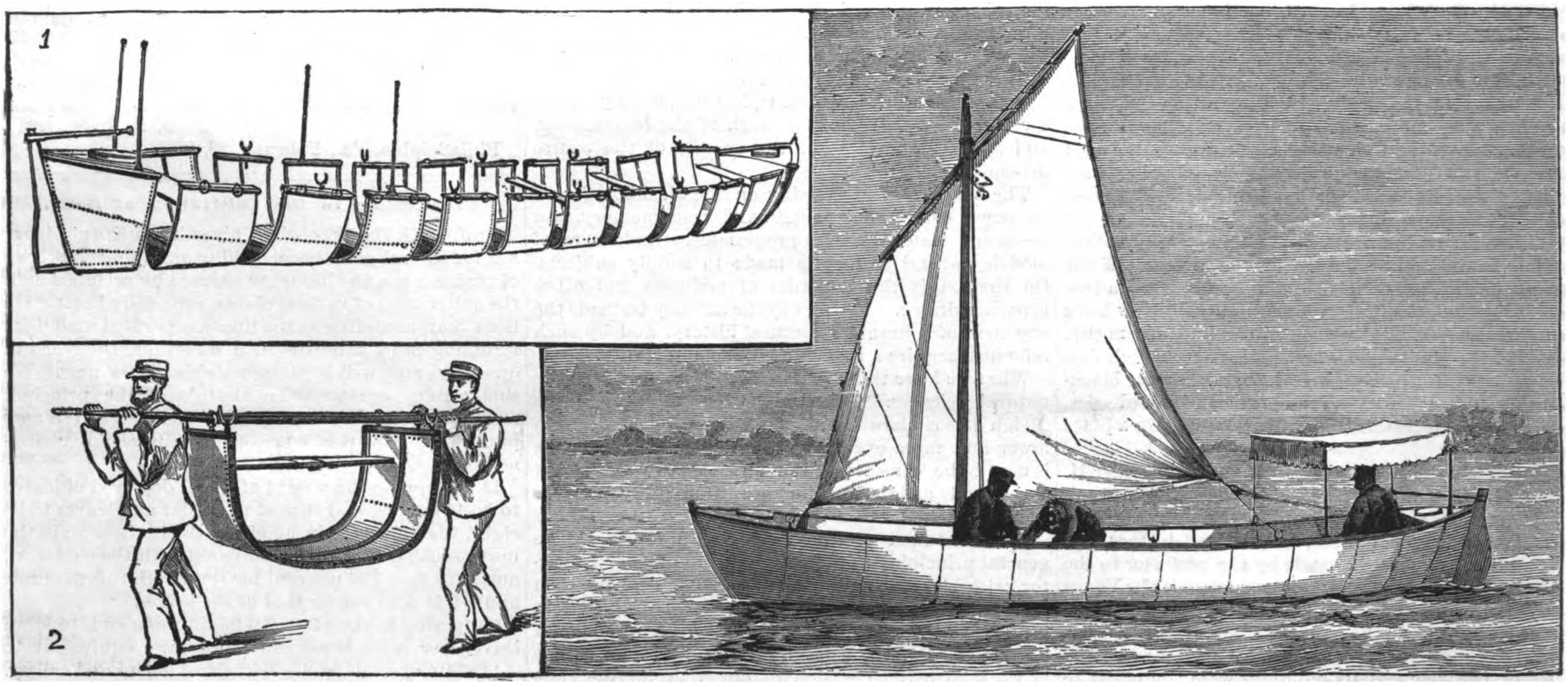
The Ring-shaped Atoms.

August Bernthsen and Hugo Scweitzer.—Among the most interesting results of recent chemical investigation must rank our recognition of the fact that there exist certain so-called "ring-shaped" groups of atoms, like those of benzol, naphthaline, anthracene, and pyridine, which are widely distributed, and which are formed with exceptional readiness. Among these a peculiar interest attaches to that ring which exists in anthracene, and which is characterized by having two phenylen groups connected by two groups of atoms, which, in the benzol residues, take up the ortho position to each other, so that with the carbon atoms in question they form a third ring of six members.

Two compounds analogous to anthracene, acridine and thiodiphenylamine, have been investigated in the Heidelberg Laboratory. These compounds, like anthracene, produce beautiful coloring matters. Thus, chrysaniline is a diamido-phenylacridine, and thiodiphenylamine passes, by the intussusception of amido groups or hydroxyles, into the leuko compounds of coloring matters, of which methylene blue is the most prominent representative. Hence it seemed to the authors desirable to examine if other diorthodiphenylene derivatives are capable of existence, and if they also are chromogens. Such a body is phenazine. The authors prove that methylphenazine and phenazine are not merely chromogens, but actually give rise to coloring matters of importance. The safranines (which contain one phenyl group more than the coloring matters of the toluylene-red group) must be referred to a phenyl derivative of phenazine, or rather of hydrophenazine.

SECTIONAL STEEL BOAT FOR MR. STANLEY.

The boat shown in the accompanying cut was constructed by Messrs. Forrestt & Son, in thirteen days, for use on Mr. H. M. Stanley's expedition in relief of Emin Pasha. It is constructed of Siemens-Martin steel, galvanized, and is divided into twelve sections, each weighing 75 lb. India-rubber is placed between the points of intersection, to prevent leakage, while the fore and aft sections are water tight, to give additional buoyancy to the craft. It is 28 ft. long and 6 ft. beam and 2 ft. 6 in. deep, and is furnished with ten oars and a large lug sail. The boat may be very rapidly taken apart and put together again, and each section may be carried by two men.—*Illustrated London News.*



1. The twelve sections. 2. Carrying a section; weight, 75 pounds. 3. The boat afloat.

SECTIONAL STEEL BOAT FOR STANLEY'S AFRICAN EXPEDITION.

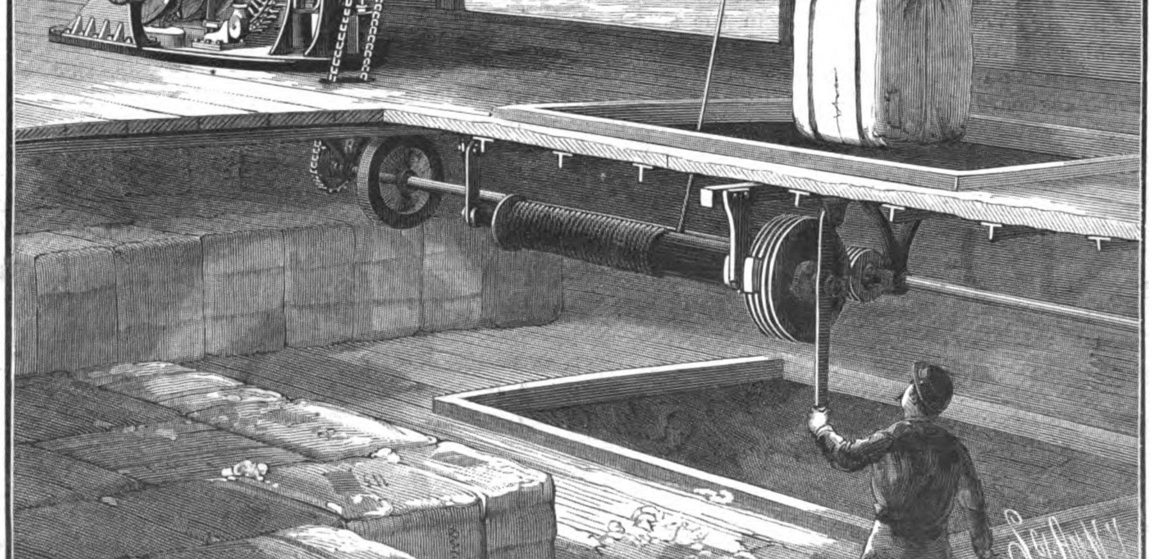
CONVERTIBLE ANCHOR AND FREIGHT HOISTING APPARATUS FOR VESSELS.

Every large steamship is provided with several small independent engines, so distributed about the vessel that the work of loading and unloading may be most expeditiously carried forward. In addition, there is usually a special engine designed to handle the anchor, and which, of course, performs no other service. By means of the invention shown in the accompanying engraving, this anchor hoisting engine may be also employed for the handling of freight, thus utilizing a machine that would otherwise be idle except during a very brief period, and thereby providing, practically, additional power without corresponding expenditure. The steam capstan windlass used in connection with this apparatus is well known and appreciated, being used by all the most important lines upon this side of the water. As all parts of the windlass are connected to the same plate, the whole must always remain in line, independent of the twists and strains to which the deck may be subjected. The engines are counterbalanced, and, together with the locking gear of the windlass and the friction levers, are placed in the most convenient position possible. An extremely simple device, placed in a well just below the worm gear, provides for the automatic lubrication of each tooth as the wheel revolves; this reduces the friction, and prevents cutting and wear.

Upon one end of the crank shaft is mounted a sprocket wheel, over which passes a chain leading to a like wheel on a shaft provided with a grooved friction pulley, which may be engaged by a second pulley on a shaft carrying the hoisting drum. This second pulley and the drum to which it is united are mounted loosely upon the shaft, but by shifting a suitably arranged lever, the drum and its pulley may be so moved as to bring the two pulleys into engagement. When the lever is released, the drum and pulley swing away from the first pulley, and their shaft revolves independently of the drum. Upon the crank shaft there is also a worm, which may be moved to throw it out of engagement with the gear wheel driving the windlass mechanism.

It is evident from the simplicity of this apparatus, and the consequent fewness of the parts, that there is no danger of derangement, while by simply shifting either of two levers the engines may be caused to operate either windlass or hoisting apparatus.

This apparatus is manufactured by the American Ship Windlass Company of Providence, R. I., to whom all communications should be addressed. This arrangement, although but recently patented, has already been placed upon two steamers and has been ordered for two others now building.



CONVERTIBLE ANCHOR AND FREIGHT HOISTING APPARATUS FOR VESSELS.

Decision in Favor of the Wheeler Wood Filler.

In the United States Circuit Court for the first circuit, at Boston, Colt, J., a final decree for an infringement and accounting was entered on the third Monday of February last, in the suit of the Bridgeport Wood Finishing Co. *vs.* Asahel Wheeler, in equity. This decree affirms the validity of the Wheeler patent, and restrains infringement thereof by the use of ground silex in wood fillers.

Testing a Gigantic Cannon.

The first three proof rounds of the powerful new gun supplied by the Elswick Works for her Majesty's barbette ship Benbow were fired February 10, at the butts at Woolwich Arsenal, the result so far going to show that this is the finest specimen of artillery yet produced in this or any other country. Among the "Woolwich Infants" it is like the famous Queen Elizabeth's bronze gun in Dover Castle among the old carronades. In length it is 524 in., or nearly 44 ft. The inner tube is of solid steel throughout, strengthened by jackets of comparatively thin steel hoops. The length of the bore is 487½ in., or about thirty calibers, and the rifling, which consists of a multitude of small shallow grooves, extends for 397·2 in., or about 33 ft. The diameter of the bore is 16¼ in. The diameter of the powder chamber is a trifle over 21 in., and its capacity 28,610 cubic inches. The twist of the rifling commences with one in 120 calibers, and increases to one in 56 calibers. The gun is mounted on a fine cast steel truck, which weighs 95 tons, and on the proof rounds it ran up the incline from about 50 to 70 ft.

The first round was fired with 600 pounds of Westphalian powder and a cylindrical projectile weighing 1,800 pounds. The velocity attained was 1,635 ft. per second, giving an energy to the projectile of about 35,240 foot tons for the penetration of armor. The second round was with a shot of like weight and 700 pounds of the same powder, being the largest charge as yet fired in England. The velocity attained was 1,843 ft. per second, the energy acquired being about 43,100 foot tons. The third round was with a similar projectile of 1,800 pounds and a powder charge of 800 pounds. The velocity attained was 2,007 ft. per second, and the energy rose to some 50,000 foot tons. The pressures of the gases within the chamber of the gun at the time of the powder discharge were 9 tons with the 600 pound charge, 12 tons with 700 pounds, and 15 tons with the 800 pound charges. The recoil of the gun in the last round was controlled by the hydraulic buffers within 4 ft. 6 in. The inner tube of the gun was in perfect condition at the termination of the day's firing. It is expected that when the next date of proof firing is determined, powder charges of 850 pounds, 900 pounds, 925 pounds, and 950 pounds will be used with projectiles of 1,800 pounds weight, and an energy on the projectile of 62,700 foot tons may be expected to be developed, capable of penetrating armor more than 3 ft. thick.

ERNST WERNER SIEMENS.

In the fields of steam engineering, of metallurgy of iron and steel, and of electricity, no name occupies so prominent a place at once in all three as that of the Siemens brothers, Werner, Carl, William, and Frederick. A review of the life of Sir William, with his portrait, has already been published by us.* In most of the Siemens inventions he had some part. Dr. Werner Siemens has won his principal fame as an electrician. He was born at Lenthe, near Hanover, December 13, 1816. He entered the Prussian army in 1838. His mind was early occupied with studies in electricity, the problem of electro-gilding engaging his attention. In his experiments on the new art, as it was then, he was joined by his brother William, six years his junior. His first patent on the subject was taken out in 1841. A year later George Elkington had executed successful plating in Birmingham. This was the beginning of the great electro-plating industry. The Siemens invention was introduced into England in 1843. Still working with his brother, he was a joint inventor of the process of astatic printing. It was described in one of Faraday's lectures in 1845, and represents the beginning of the reproduction of prints and drawings. It was mechanical and chemical, the resinous matter of the ink of a printed page being destroyed by caustic baryta or strontia, and the letters being then transferred to a zinc plate by pressure. Photographic processes have now superseded this method.

In 1844 he assumed the charge of the government artillery works at Berlin, but continued to devote himself to electricity. In 1847 he laid the first sub-aqueous telegraph line, insulated with gutta percha, across the Rhine at Cologne, a distance of one-half mile. A year later he experimented at Kiel with submarine mines exploded by electricity through his cable. In 1849 he left the army and founded the great telegraph construction house of Siemens & Halske, in Berlin.

To the year 1856, a period when the mechanical generation of electricity, founded on Faraday's researches, was in its infancy, the old Siemens H armature is referred. This antedates the Pacinotti ring four years. It is not easy to ascertain to which brother it is due, or if to both. The prolific nature of both makes it difficult to accurately define their individual work. Sir William took out about one hundred patents of his own, while forty or fifty inventions stand to the credit of the brothers jointly.

In 1858, Werner Siemens, with Herr Halske, his partner in Germany, and with his brother William, founded the English house of Siemens & Halske, at Charlton, West Woolwich, a branch of the Berlin establishment, and principally in Sir William's charge.

Eleven years after the invention of the armature, Werner sent a very remarkable paper to his brother, in London. On the 14th of February, 1867, Sir William read it before the Royal Society. Its subject was "On the Conversion of Dynamic into Electrical Force without the Aid of Permanent Magnets." A paper on an identical subject was read by Sir Charles Wheatstone on the same evening. In these papers, for the first time, the principles of the dynamo-electric machines were laid down—the self-contained, self-exciting dynamo was then disclosed simultaneously by both scientists. It forms one of the remarkable coincidences of invention. The discovery is claimed, as independent inventors, by Varley and Hjorth.

The subject of electrical railroads engaged his attention for many years. He proposed to establish them in Berlin, but the city authorities interfered and stopped it. He exhibited one at the German Industrial Exhibition in 1879, and eventually built a short line in the suburbs of Berlin, the Lichterfelde road, which was opened in 1881. At the Paris Exposition of Electricity, in the same year, he ran a line carrying many thousand people successfully and without accident. The Portrush line, in Ireland, is worked largely on the same plans, and was built under the supervision of his brother.

Among his inventions may also be named the method for determining the position of faults in submarine cables—something essential to the economical success of long submarine cables.

The business and engineering enterprise and achievements of the firm of Siemens & Halske in telegraph construction is worthy of notice. They are the only rivals of the Telegraph Construction and Maintenance Company, of East Greenwich, England. The Indo-European overland telegraph line was built by them, through almost unexplored countries, across Russia and Persia to India. It was built under the agreement that no payment should be made to the firm until a dividend of 12½ per cent had been earned on the paid-up capital.

Years were consumed in the work, which has proved a commercial success. The connection of the firm with it terminated in 1882. The story of the difficulties encountered and overcome in this work reads like a novel. They laid the direct U. S. cable, the Brazil line, the North China line, and the ocean is everywhere underlaid by their cables, placed in position by their special cable-laying ship, the Faraday.

The Siemens armature, already spoken of, was the old grooved or H armature. The more recent one, the drum armature, resembling in its theory the Gramme or Pacinotti ring, is to-day used in probably a third of existing dynamos. A great proportion of motors also embody it in their construction. The Weston dynamo, as made by the United States Electric Lighting Company, contains it. The Siemens electrical lamp also stands very high in order of merit.

Thus Ernst Werner Siemens stands as one of the pioneers of electricity in almost all its applications—electric plating, telegraphy, submarine cables, mechanical generation of electricity, and electric lighting. In much of his work he cannot be separated from his brother.

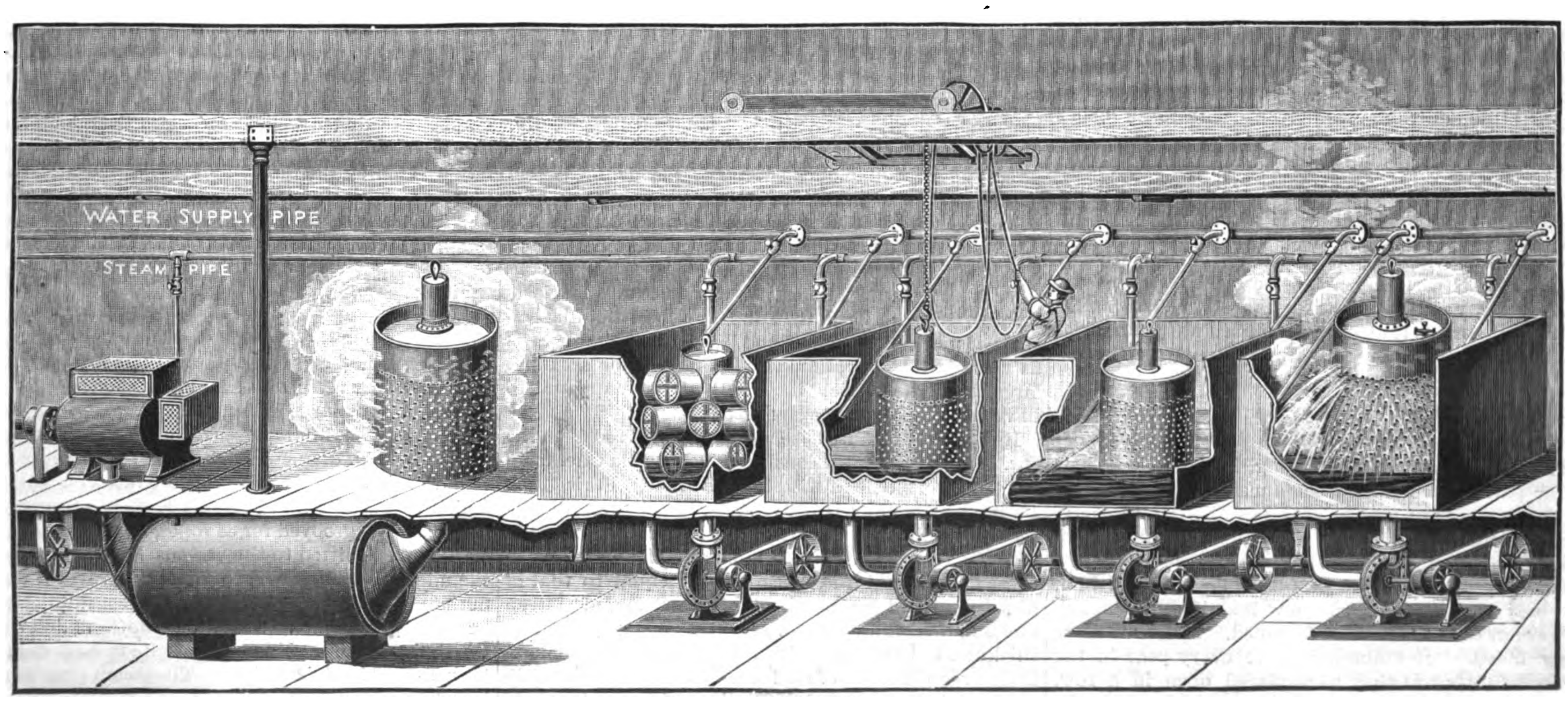
* See SCIENTIFIC AMERICAN SUPPLEMENT, No. 353, and SCIENTIFIC AMERICAN, vol. xlix., p. 388.

DR. WERNER SIEMENS.

MECHANICAL DYEING.

That modern industry ceaselessly aims to make itself independent of hand labor is a fact well known, and many useful apparatus and contrivances have been already devised for effecting this object in the different branches of the tinctorial trades. The dyeing of loose wool and cotton also have had their share of attention at the hands of inventors, without, however, bringing forward any very striking changes over the old methods until within the last few years. The process under consideration may be considered as a thoroughly modern method. It relies, of course, on the well known and necessary principle of effecting a circulation of the dyeing or mordanting liquids; but, unlike the older systems, the material is left standing while the liquids are kept in motion. It is to the mechanical arrangements, therefore, that our attention must be first given, and then to the amount and quality of the work performed.

As will be seen from the illustration, the dyeing apparatus consists of a cistern in which the dyeing or mordanting operations are performed. The material



IMPROVED MECHANICAL DYEING PROCESS.

is placed in the cylinder, which is a perforated vessel of copper, or even galvanized iron, according to the nature of the bath, and this cylinder is fixed at the bottom of the cistern and put in communication with a centrifugal pump, which forces the dyeing or mordanting liquors through a pipe into the cylinder, and after reacting on the material through the perforations all over the surface of the cylinder, back again into the dyeing cistern. This latter is filled only with sufficient liquor to affect the dyeing or the mordanting of the material, and consequently it is possible to work with stronger liquors, which means also a saving in the fuel, since only small quantities of liquors have to be heated, and not as in the old process of having to heat comparatively a large amount of liquor for a small quantity of the material. The liquors in the cistern only average in all about 15 inches.

The construction of the cylinder or receptacle for holding the material to be treated differs according to the nature of the material itself, and consists either of a plain cylinder with a perforated column in the middle, with which it communicates with the pump, or the apparatus is of more complicated construction, having one central cylinder and several others protruding from it, in which the material is placed, and is especially suitable for the dyeing of tops. In both cases the main cylinder is supplied with a lid to press down the material and keep it in its place, and at the same time to allow, by means of a hook at the top of the lid, the whole of the cylinder to be lifted up and down by a crane, and thus a great saving of labor and handling is effected.

To this must also be added the advantage of its being possible to do all the operations of mordanting, dyeing, or washing without removing the material from the cylinder. The drying may similarly be done without removal of the material, it being only necessary to put hot air through after the drying and washing off are completed, since from the first placing of wool in the apparatus to its being completed in a dyed and thick state, there is no handling required. As to the amount turned out, three men will do 12,000 lb. to 15,000 lb. of wool a week, of course according to the quality of the wool. The dyeing of blacks especially seems to be effected with special ease and thoroughness by this system, either for wool in the sliver or loose wool; the method of dyeing being the well-known process of mordanting with bichromate. This operation lasts one hour; the dyeing itself takes one and one-half hours for the washing, or two and one-half hours in all.

We have seen the process at work in the extensive establishment of Messrs. Markendales, in Salford, and are thus enabled to give details.—*Textile Manufacturer.*

Grano-Metallic Stone.

The grano-metallic stone, the invention of Mr. J. H. Bryant, of London, is composed of blast furnace slag and granite, which are crushed, chemically treated, dried, and mixed with Portland cement. For use these ingredients are brought to a pasty consistency with an alkaline solution, and laid. It possesses the important property of always having a rough surface, which is due to the atoms of the vitreous slag always presenting themselves just above the other ingredients, which are more readily worn. This stone has undergone a special trial in one of the metropolitan gas works, where a section was laid at the request of the engineer. It was there successfully subjected to tests which natural and artificial stones have, it is stated, been unable to withstand. It is found to stand not only the wear and tear of heavy horse and van traffic, but the sudden and extreme alternations of temperature incident to the slaking of coke upon it. Valuable as this material has proved itself for paving and road making purposes, however, it has now been proved to possess the additional important feature of being highly refractory.

A cement kiln lined with this stone has stood a number of burnings without any repairs having to be done. Even where the lining happened to be torn away by a portion of adhering clinker, there is not the least sign of the stone having been injuriously acted upon by the heat. This is certainly a most crucial test, and the satisfactory manner in which the stone has passed through it stamps it at once as an absolutely fire proof material, and, therefore, of special value for constructive purposes.—*Iron.*

Umbrellas.

The Chinese and Japanese, long, long ago had their queer parasols, and in Burma a man's rank is known by the number of umbrellas he is allowed to carry, the king limiting himself to 24. Jonas Hanway introduced the umbrella into England more than a hundred years ago. The people all made fun of him, but may be it was because they hadn't sense enough to get out of the wet when it rained. There are more than 7,000,000 of umbrellas made every year in the United States. If they were placed open in a row, allowing three feet of space for each, they would make a procession more than 8,000 miles long.

THE EPIORNIS.

Michelet, in his book, "The Bird," thus speaks of the *epiornis* as the conqueror of the giant saurian, the *plesiosaurus:*

"Who would have met face to face the horrible leviathan? The capacity of flight was absolutely needed, the strong, intrepid wing which from the loftiest height bore down the Herculean bird, the epiornis, an eagle twenty feet in stature and fifty feet from wing tip to wing tip, the implacable hunter, who, lord of three elements, in the air, in the water, and in the deep slime, pursued the dragon (*plesiosaurus*) with ceaseless hostility."

This rhapsody of our brilliant writer has for text little more than the egg which is illustrated in our cut. Michelet's imagination has supplied most of the material, and has done well. It is certain that the egg never could have produced so marvelous a creature. The epiornis was probably a strictly terrestrial bird, incapable of flight. Nothing has been found to determine its conditions and way of existence, except some eggs and a few other semi-fossil remains. The giant bird of Madagascar otherwise belongs to tradition. The Sakalawas of Madagascar tell of a bird that kills cattle and devours them. To it they attribute these eggs, still occasionally found. The fact that new species are continually being discovered on the island lends some probability to the expectation that a living epiornis may yet be seen. Its remains occur in recent alluvial

EGG OF THE EPIORNIS.

deposits, and from their recency are classified as subfossils. The legend of the ferocity and carnivorous habits of the bird are groundless. In all probability it was a vegetable feeder. Tradition has brought down to us a similar tale of the extinct dinornis of New Zealand. It is said to have been seen by some sailors, who, frightened at its size and height, left it unmolested. But while the remains of this bird include organic tissue, and bones still impregnated with gelatine, the epiornis has left no such recent relics. All that has been found of it belongs to an earlier period.

In 1850 Isidore Geoffroy St. Hilaire exhibited the egg of the epiornis to the French Academy of Sciences, and named its producer the E. maximus. The museum in Paris placed the egg in its collection, and a few of the bones, constituting enough to classify it imperfectly, were brought to Paris a short time after. Three and possibly four well defined species of the genus, placed in the family of Struthionidæ (ostriches), have now been identified. It comes in the same order with the dinornis and the rare apteryx, soon to become extinct also, though at first there was some disposition to consider it reptilian. The extinct dodo of the Mauritius Islands, immortalized by Du Maurier in his illustrations of "Alice in Wonderland," gives a probable type as regards its appearance. Though five or six times larger than the ostrich, its height is not supposed to have exceeded ten or twelve feet.

Its egg is of gigantic size, as may be inferred from the cut. Its exact dimensions are given by De Chenu, in his "Encyclopedie d'Histoire Naturelle," Paris, 1875. Its largest diameter is 13·38 inches, its smallest diameter 8·86 inches. The largest circumference is 33·46 inches. Its capacity is 77 quarts. Compared with those of existing birds, its capacity is equal to that of fifty thousand humming bird, of six ostrich, of sixteen and a half cassowary, or of seventeen emeu eggs. The thickness of the shell is given by the same author as a little over one-tenth of an inch. In the *Magasin Pittoresque*, for 1851, one of the earliest references to it may be found.

The discovery of these eggs recalls the roc of the "Arabian Nights," and in the natural histories we even find this allusion. But they do not come near the size requisite to remove the roc from the realms of myth.

There is a curious confusion noticeable about the spelling of the name. It is spelt æpiornis or epiornis. St. Hilaire, in naming it, is said to have derived its title from the Greek words επι, above, and ορνις, a bird, presumably in allusion to its size. If this derivation is correct, a very general error in the spelling seems to have been fallen into by modern naturalists. The diphthong is used in the article on birds in the last edition of the "Encyclopædia Britannica."

Instantaneous Method of Retting Flax.

The retting of flax is an operation designed to convert the pectose that surrounds the fibers of cellulose, in the green plant, into pectic acid, which, in the retted material, constitutes the brilliancy, and facilitates the sliding of the fibers in a longitudinal direction during the various operations of spinning. The detaching of the boon is a useful consequence of this transformation of the pectose.

Flax is usually retted by allowing it to undergo the long and irregular action of fermentation. In the *Bulletin de la Societe Industrielle du Nord de la France*, Mr. P. Parsy describes a method which he calls "instantaneous retting," and which consists in converting the pectose into pectic acid by a method pointed out by the chemist Fremy, that is to say, by heat. He first submits the flax to the action of water under pressure, at a temperature of about 150° C., and then finishes the operation by substituting for the water steam under pressure at the same temperature. Under the action of the heat, the transformation of the pectose begins. The steam, which has not the same dissolving effect as the hot water, permits of afterward maintaining the temperature necessary to finish the conversion of the pectine into pectic acid, without the loss of any of this valuable substance. The operation takes but an hour and a half.

By this process, Mr. Parsy succeeds in giving the retted flax either a blue or yellow color at his pleasure. For blue, he uses the water of a preceding operation, which is then slightly acid from the organic acids of the flax that it holds in solution. For yellow, it is only necessary to employ a slightly alkaline water.

One of the principal advantages of the method resides in the rapidity with which the drying is effected. Mr. Parsy states that the flax, on being removed from the steaming apparatus, contains but one and a half time its weight of water.

Varied Accomplishments of an Armless Man.

There recently died at Potsdam, St. Lawrence County, N. Y., Richard Donovan, who was in some respects one of the most remarkable men in northern New York. Twenty years ago, when a boy, Donovan worked in a flour mill. One day he was caught in a belt and received injuries that necessitated taking off both arms at the shoulders. This misfortune did not discourage him, and, after recovering his health, he set about earning his livelihood as best he could without the use of hands or arms. Part of the time he had lived alone, and from the necessity of helping himself he became wonderfully adept in performing all kinds of work, using his feet and mouth principally. He owned a horse, of which he took the entire care, harnessed it, fastened and unfastened the buckles with his teeth, and drove with the reins tied around his shoulders.

Being in need of a wagon, he bought wheels and axles, and built a box buggy and painted it. He went to the barn one winter day and built a cow stable, sawing the timber with his feet, and, with the hammer in one foot and holding the nail with the other, he nailed the boards on as well as most men could do with their hands. He dug a well twelve feet deep on a farm in this town, and stoned it himself. He could mow away hay by holding the fork under his chin and letting it rest against his shoulder. He would pick up potatoes in a field as fast as a man could dig them. He would dress himself, get his meals, write his letters, and in fact do almost anything that any man with two arms could do.—*Boston Transcript.*

A Large Engine.

Messrs. Douglas & Grant, Dunnikier Foundry, Kirkcaldy, have at present in hand a compound Corliss engine of a very large description, for a cotton mill in Bombay. The high pressure cylinder of this large engine is 40 in. diameter and the low pressure cylinder 70 in., each having a stroke of 6 ft. The fly wheel, which weighs about 110 tons, is 30 ft. in diameter by 8 ft. 6 in. wide, grooved for 38 ropes, by which the power is to be transmitted to the various lines of shafting in the mill. The engine is to run at 60 revolutions per minute, giving a speed of ropes of considerably over one mile per minute. The crank shaft, made of Whitworth fluid compressed steel, is 25 in. in diameter in the body and 20 in the bearings. The steam pressure is to be 100 lb. per square inch, and the engines will work easily up to 2,500 horse power.

NEW TORPEDO BOAT FOR THE SPANISH GOVERNMENT.

In view of the large sums recently appropriated by Congress for the construction of war ships and torpedo vessels, the new vessels and improved naval structures of other governments assume especial interest on this side of the Atlantic. We give herewith illustrations of a remarkable torpedo boat lately built in England for the Spanish government, for which, and the subjoined particulars, we are indebted to the *Engineer*. The name of the vessel is El Destructor.

She is a twin screw cruiser of nearly 200 feet length. Her beam is 25 feet, and her depth 13 feet. She is built of high tension steel, and consequently her scantlings are light; but to give her the requisite rigidity she has a large number of partial bulkheads throughout her length. In order to avoid the ravages of corrosion as much as possible, every piece of steel or iron in her is galvanized. It is usual in small vessels such as torpedo boats to galvanize the whole of the material to the height of the water line; but we know of no vessel which can be called seagoing which is galvanized throughout.

The scantlings in torpedo boats are so light that the greatest care has to be taken in looking after these boats; but in a vessel which is intended to act as a cruiser it is an indispensable condition that those who have charge of her should not be in such fear and trembling as they would be if her scantlings were those of a torpedo boat. Hence in the Destructor it has been necessary to have many parts in excess of requirements of strength, solely to avoid the risk of effective damage from corrosion. It is obvious that in a vessel of this size, attaining, as she does, such an enormous speed as 23 knots, the greatest attention must have been given to saving of weight in the hull and machinery. Her designers and constructors, Messrs. Thomson, are both torpedo boat and cruiser builders, and consequently this vessel has partaken as much as possible of the advantages of the torpedo boat without sacrifice to her qualities of seagoing cruiser. As may be seen from the illustration, she has a ram bow, which would be used without much hesitation by a daring commander. She has a bow rudder, which has been fitted to her partly to assist her maneuvering and partly to act as a leeboard when she is under sail. It would also be of advantage in case of derangement of the after rudder. It is not, however, of so much importance in this vessel as it is in the ordinary torpedo boats in which it is usually fitted, for the Destructor has a new type of rudder fitted, known as Thomson and Biles' patent sternway maneuverer, which is a development of the rudder we described as being fitted to the Russian torpedo boat Wiborg, in our issue of October 22. This rudder, in the Destructor, has an area of 80 square feet. The lines of the ship are carried out to the back of the rudder, and the profile view of this back gives the stern the appearance of an ordinary narrow yacht's rudder.

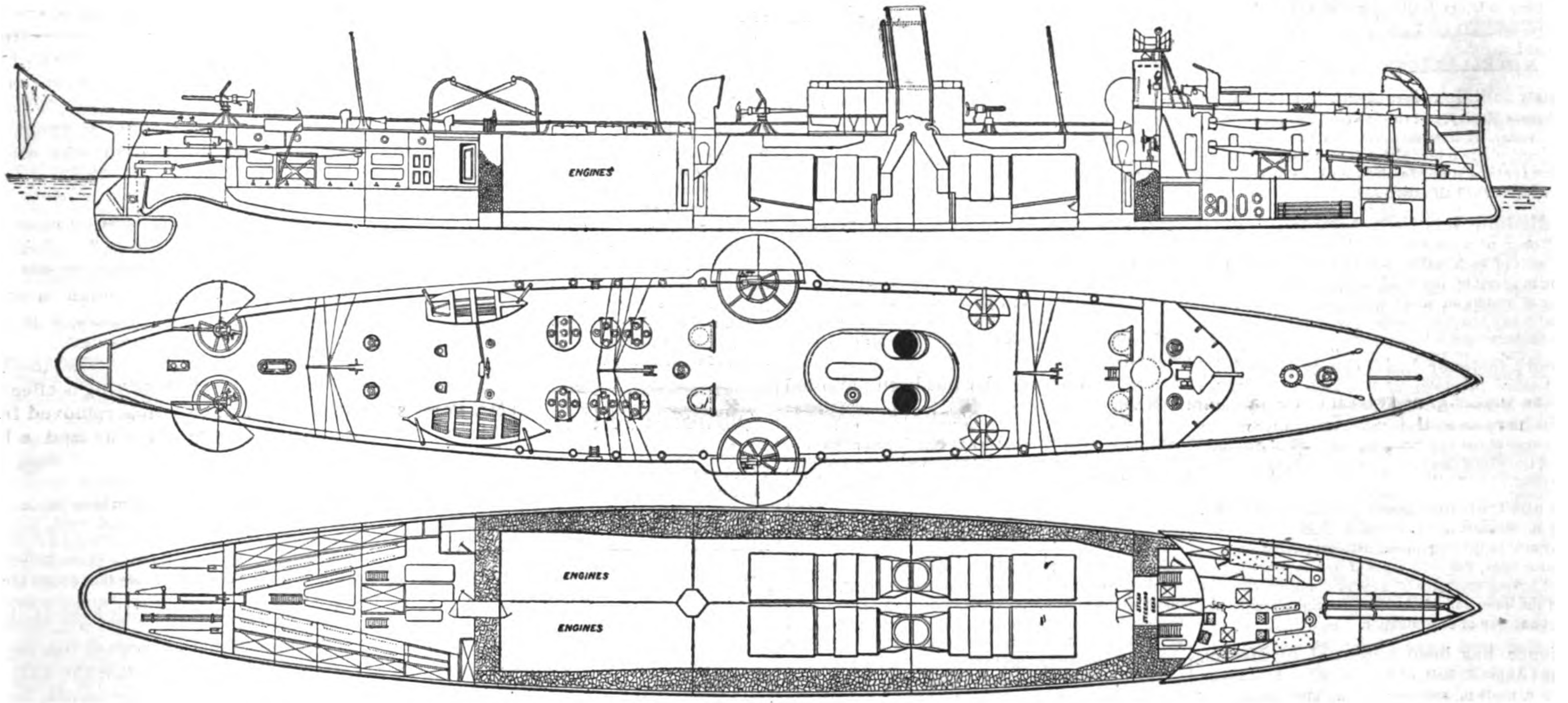
A closer examination shows that the ship is divided by a horizontal plane at about the water line, and when the helm is put over, the whole of the after part of the ship below the water line swings bodily round. The deadwood is arched up sufficiently to allow the two propellers to be as near as possible; but the chief point of value in this rudder is the partial compensation on the forward part. It is known that if a plane surface is advancing through water at an oblique angle, the pressure on the fore end of the plane is very much greater than on the after end. The effect of this is that the pressure on the comparatively small portion on the fore side practically balances the twisting moment caused by the pressure on the after side. This results in a double advantage—the first is, that the strength of all the steering apparatus may be very small; the second is, that as long as the proportion between the areas is properly maintained, the rudder area, and consequently the turning or maneuvering power of the boat, may be increased indefinitely. This rudder has not the disadvantage of the completely balanced rudder which has been fitted in vessels of the Royal Navy, for the pressure against the upper deadwood caused by the reaction of the pressure on the rudder is very effective itself in turning.

Further, the advantage of having the vessel completely under control when going full speed astern is very great, and has never been attained by an ordinary rudder. The part of the rudder on the fore side, in this new plan, then acts exactly as an ordinary after rudder would, because it is on the after side of its axis. This form of rudder has been very successfully fitted in some torpedo boats built for the British government by Messrs. Yarrow & Co. One of these boats was tried recently, and our contemporary, *Engineering*, in a recent issue, speaking of these trials, says: "The helm was put over at once, as fast as the powerful steam gear would work it, either to port or starboard. The result was remarkable, not to say startling. The enormous rudder area would at once throw the stern round, and the great column of water would rise up aft, the boat would heel inward somewhat, and the circle was completed in a marvelously short space of time." We gave the results of the turning trials of the Destructor, in our description of December 25. The steering gear which works both bow and stern rudder is an arrangement of Messrs. Muir & Caldwell's, and it has the additional capability of being able to work the capstan. The torpedo armament of this vessel consists of two tubes in the bow and one in the stern, each tube having two torpedoes appropriated to it. Two broadside tubes are to be fitted on the upper deck, but the exact type is not yet decided. The gun armament consists of one 9 centimeter central pivoted gun on the forecastle, four 6 pounder rapid firing guns on the broadside, and two 37 mm. Hotchkiss revolvers forward.

With this armament the Destructor ought to be capable of justifying her existence if ever she meets a fleet of torpedo boats. She is divided into thirty-nine water tight compartments, some of which are again divided by having a double water tight side, so arranged that the space between the two skins forms bed places. The engines are in two separate compartments, the boilers are in four. The boilers and engines are completely encircled by coal bunkers. The bunker bulkhead abreast of the machinery is ¾ inch thick, and affords protection against small gun fire. A cross bulkhead forward of a circular form is fitted to protect the boilers, engines, magazines, and steering gear from raking fire. A circular conning tower, affording protection from small gun fire, is fitted well forward. There are three masts, with a fore and aft rig. These masts hinge down, the whole being arranged so that the operation of striking the masts may be done in a few minutes. The engines are triple expansion. The boilers are of the locomotive type, and the full power of 3,800 horses was attained for the moderate mean air pressure in stokeholes of 2¼ inches. This very moderate pressure compares well with the usual practice of torpedo boats, which is from 4 inches to 6 inches, and the results in consumption of fuel and condition of boiler were most satisfactory. The boilers did not show a single weep or sign of leakage, and the consumption for four hours was only at the rate of 2·1 pounds per I. H. P. per hour, showing that the vessel could steam at full speed for about 700 knots. There is no other vessel afloat that could go 700 knots in thirty-two hours, or even could go 525 knots in twenty-four hours, which is at the same rate. There was no reason, at the end of the four hours' official trial of this vessel, why she should not have gone on at the same speed for twenty-four hours. The radius of action of this vessel at 11¼ knots was proved to be 5,100 knots.

This vessel is the first of a type which has long been asked for by naval officers. Placed under the charge of any of our best young lieutenants or commanders, such a vessel would be of the greatest service to a fleet. Vessels of this type are not expensive.

Why is it that with the best skill in the world in ship designing, with the best experience in naval construction, and with the most energetic and able naval officers in the world, our Admiralty allow themselves to be hopelessly beaten by a private firm of shipbuilders? Why cannot they do in vessels of this class, as we understand the Spanish Minister of Marine did in the case of the Destructor, state his conditions and ask private shipbuilders to produce designs in competition? If the conditions are clearly stated as to armament, radius of action, tonnage, complement, and sail area, leaving the builders to say what speed they will guarantee and what price they will charge the whole matter will then be in a form for settlement by any person of common sense. Naturally the Admiralty constructors and engineers will wish to criticise the designs, but if the firms selected for the competition be limited to those really competent, the criticisms of the constructors and engineers will not be any hinderance to the work of selecting the best, for the matter will be, in the way suggested, largely a question of who will guarantee the most speed, and is the highest speed offered worth the price asked? We may very well take a lesson from the Spaniards in this matter, and release some of our ablest naval constructors and engineers from their work of discussing these questions so wearily over and over again with every new official who has the power to ask questions and the wish to be educated, and to give them an opportunity of using their well recognized skill and ability in bringing our dockyards to the level of private shipbuilding yards in economy of production and in rapidity of delivery.



EL DESTRUCTOR—NEW TORPEDO BOAT FOR THE SPANISH GOVERNMENT.

Cheap Method of Platinizing Metals.

In this new process, the metallic object is covered with a mixture of borate of lead, oxide of copper, and spirits of turpentine, and submitted to a temperature of from 250° to 330°. This deposit, upon melting, spreads in a uniform layer over the object. Then a second coat is laid on, consisting of borate of lead, oxide of copper, and oil of lavender. Next, by means of a brush, the object is covered with a solution of chloride of platinum, which is finally evaporated at a temperature of not more than 200°.

The platinum adheres firmly to the surface, and exhibits a brilliant aspect. If the deposit be made upon the first coat, the platinum will have a dead appearance. Platinizing in this way costs, it is said, about one-tenth the price of nickel plating.—*Le Genie Civil.*

ENGINEERING INVENTION.

A car coupling has been patented by Mr. Reuben E. Woods, of Montgomery, Minn. Combined with the drawhead and its coupling pin, a hook is pivoted within the drawhead above the link chamber, and a block arranged to swing downward within the link recess, and beneath the coupling pin when the link is withdrawn, making a coupler wherein the parts may be set for automatic coupling.

AGRICULTURAL INVENTIONS.

A potato planter has been patented by Mr. William C. Davidson, of Grandville, Mich. This invention covers a novel construction and combination of parts in a machine adapted to open furrows, drop the seed, cover them, press the soil down, and mark the rows as the machine is drawn across the field.

A thatched cover for stacks has been patented by Mr. Robert Griswold, of Woody, Kansas. It is made in sections, of vegetable fibers sewed together, with ropes having loose upper ends to be tied, and loose lower ends to receive balancing weights, making an adjustable cover which will allow steam to escape, while excluding rain.

A fertilizer distributer has been patented by Messrs. Bryant Smith and Henry C. Jenkins, of Brownsville, Ala. It may be drawn by a horse or operated by a man to distribute the fertilizer in drills over from three to five acres of land in a day, the machine being inexpensive, and using the fertilizer without waste.

A reversible sulky plow has been patented by Mr. James Willson, of Tomah, Wis. Its construction is such that the plows can be easily reversed, the main frame leveled on laterally inclined ground, the plows raised from the ground or adjusted to work to any desired depth, and the plows tilted laterally to adjust them to lateral inclination of the ground.

MISCELLANEOUS INVENTIONS.

A saw mill dog has been patented by Mr. Thomas Manley, of Prince Albert, Northwest Territory, Canada. It has novel features of construction, and is particularly intended for dogging small tapering logs, but is also adapted for dogging large straight logs or for holding the half sawed log.

A windmill has been patented by Mr. Peter Kohnz, of Avon, Ohio. It is self-governing, and all the sails of each section have a uniform motion in moving in or out of the wind, the platform carrying a number of rollers on which there is mounted a turntable with two boxes or bearings, in which is mounted the main shaft.

A cork fastener has been patented by Mr. Abraham Denebeim, of Evansville, Ind. It is a plate with right-angled arm and disk to fit on top of the cork, the plate being apertured at one end and having a tongue at the other end, the device being a single piece of tin, which can be readily bent to form an effective fastener.

An ant trap has been patented by Mr. Walter R. McCallum, of Waelder, Texas. The body has inward projecting tubes, with protecting caps on their inner ends, the outer faces of the caps being convex and having apertures of greater diameter than the bore of the inner end of the tube, making a simple and efficient ant trap or exterminator.

A fence has been patented by Messrs. John and Anton E. Reif, of Branch, Wis. It is a portable fence, made in sections, the invention consisting principally of the foot pieces, in apertures of which fit the lower ends of the posts, making a fence which is very stable and not liable to be blown over, and which is very simple in construction.

A marine boat slide has been patented by Mr. Harry H. Schaefer, of Point du Chene, N. B., Canada. It is a novel construction of inclined frame or roadway, with its lower end extending beneath the surface of the water, the keel of the boat sliding in runners, and the edges of the boat having guards to prevent the water from splashing upon the passengers.

A washing machine has been patented by Mr. Charles W. Turner, of Meriden, Kansas. The construction is cheap and simple, and the machine is adapted for use with any tub, clamps or fastenings being unnecessary, as the operator in bearing down upon the handle in working holds the machine and imparts pressure to the clothes, water being continuously forced through them.

A two wheeled vehicle has been patented by Mr. Emery W. Baxter, of Burr Oak, Mich. The construction is such that the body may be adjusted to vary its leverage action upon the springs to adapt the springs to the weight of the rider, and this adjustment can be effected without removing nuts and bolts, and the body is so supported that horse motion is in a large measure neutralized.

A stone and ore crusher has been patented by Mr. Daniel Brennan, Jr., of Salterville, N. J. In a suitable supporting frame is a fixed die and a movable die, a reciprocating ram and suitable mechanism for driving it, whereby the ram is made to strike suddenly against the movable die and with great force, the invention being designed to make the crushing and discharging action more effective.

A machine for forming sheet metal has been patented by Mr. Michael T. Durkin, of Brooklyn, N. Y. This invention provides a machine for forming straight or curved mouldings in sheet metal by means of dies adapted to an ordinary drawing or foot press, by which the flat edges of the guiding dies are presented to the curved surfaces of the work, so that the work is not indented by the corners of the dies.

A machine for grinding hand cards has been patented by Mr. William S. Burton, of Maryville, Tenn. In connection with an emery grinding cylinder which is automatically vibrated in the direction of its length, are means for conveniently holding the hand cards so that their wires will be held at the desired angle to the grinding surface, the machine being adapted for cards of variable length and width.

An extractor for headless shells has been patented by Mr. Charles H. Keenan, of Fort Helleck, Nevada. It is a cylinder with the general form of a cartridge and having a head fitted to the recess in the breech of the gun bored axially, with a rod extending its entire length, the cylinder having a notch in one side, in which is loosely placed a dog retained by the rod extending through the bore of the cylinder.

A lamp trimmer and extinguisher has been patented by Mr. William W. Haviland, of Plainfield, Mich. The trimmer is mounted on the wick chamber, and consists of an upwardly extending jaw, formed with clamps that partially encircle the wick chamber, a thumb wheel operating jaws to remove the charred remains from the top of the wick, while the raising of the jaws makes them act as an extinguisher.

A diffraction camera has been patented by Mr. John Vansant, of St. Louis, Mo. The diffraction diaphragm is formed of two very thin strips of suitable material secured together and having slits at right angles to each other, forming a rectangular aperture, whose diameter must in no case exceed seventeen one-thousandths of an inch, with other novel features, calculated to give clear cut and well defined photographic pictures.

A machine for testing the friction of metals has been patented by Mr. Ezra L. Post, of New York City. It has a non-conductive frame supporting independent boxes carrying separate metals, a shaft keyed centrally thereto, independent weighted levers pivoted upon each box, and incased thermometer entered through the boxes and metals to a bearing on the shaft, for ascertaining the relative frictional resistance of metals.

A cotton picking machine has been patented by Mr. John C. Johnston, of Douglasville, Ga. The box or frame of the machine is in two parts, between which the rows of cotton plants pass, and barbed fingers which rotate horizontally project into the plants from each side and pick the cotton, which is then stripped off and delivered into a suitable receptacle, the mechanism for operating the fingers constituting the chief feature of the invention.

A heel for boots or shoes has been patented by Mr. John T. Gray, of Gray, Dakota Territory. The main body of the heel is cut away to form a recess at its lower back portion, with a bottom lift or projection left at the forward part, and in the part cut away is fitted an annular metal plate, within which is fitted a leather lift or disk, preventing uneven wear of the heel, without the heel making the sharp metallic click in wear.

A telegraph sounder has been patented by Mr. Reuben C. Rutherford, of Quincy, Ill. It has an armature lever carrying two hammers, combined with a casing containing the sounder and having an adjustable resonant cover for receiving the blows of the hammer, the device being portable, and adapted for receiving messages direct from the line, or through a relay and local circuit, or to produce signals audible at a distance or very light ones.

A spring bed bottom has been patented by Mr. George Steinson, of Guttenberg, N. J. Combined with a network of coiled wire springs connected to a suitable frame are shackles for the springs, to prevent their being too far distended by heavy weight upon the bed, the springs having loops or hooks at each end to connect with chain shackles, and there being a metal coupling with headed arms to connect the chains to form the network and to connect the network to the frame.

A fare box forms the subject of two patents issued to Mr. Timothy L. Beaman, of Knoxville, Tenn. The inventions relate to an arrangement of a sinuous pay chute and a hopper which receives the fares therefrom, both situated in the upper part of the fare box, which is of a kind to be used in street railroad cars, omnibuses, etc.; the box is so constructed that it may be repaired conveniently should the glass be broken, and has more effective safeguards against the abstraction of fares than other similar boxes.

NEW BOOKS AND PUBLICATIONS.

THE PRINCIPLES AND PRACTICE OF CANAL AND RIVER ENGINEERING. By David Stevenson, F.R.S.E., M.I.C.E., author of a "Sketch of Civil Engineering in North America," etc. Edited and revised by his sons David A. and Charles A. Stevenson. Third edition. New York: Scribner & Welford. Pp. 406, large octavo, 18 plates.

The first edition of this valuable work was published in 1858, being revised and enlarged from the article "Inland Navigation" in the eighth edition of the Encyclopædia Britannica. The second edition, with much new matter, appeared in 1872. This edition is out of print, and the inquiry for the work has grown into such a demand as to necessitate a third edition. The first two chapters are devoted to a brief sketch of the early history of barge canals, giving a general description of some of the famous ship canals of the world, without entering into the technical details of their construction. The second and larger part of the work contains a general and technical review of river engineering, presented in a clear and interesting manner. Among the topics treated of we note the following as being of timely interest: The compartments of rivers defined; the tides of rivers, their variations; the general rules for taking soundings, with applications; American methods of taking elevations along a tidal river without leveling. The discharge of rivers, undercurrents, velocities of flow, floods, methods of studying currents. The watersheds of rivers, and methods of rendering small rivers navigable. Tidal propagation and currents of rivers. Removal of obstructions to tidal flow; the dredging of navigable streams, the discussion of "jettying," the improvement of rivers. Docks, tide basins, harbor bars and barless rivers. The reclamation of land, and the crossing of navigation highways by bridges. The plates illustrate plans and sections of the Caledonian, Amsterdam, and Suez Canals, charts of Dornoch Firth, the Dee, the Lune, the rivers Tay, Ribble, estuaries of the Clyde and the Foyle. Diagrams of tidal lines of the river Dee, during flood of a spring and an ebb tide, and diagrams of tidal waves in the Firth of Forth and in the Clyde. The work is marginally annotated for ready reference, in addition to having a well classified index. American engineering practice is largely drawn upon throughout the work, and many valuable records of fact are herein embodied in permanent form. The vast amount of money paid out by the United States Government annually for river and harbor improvements has made the reappearance of this standard work of timely importance to all American engineers.

DIE SCHIFFSMASCHINE, Busley. Ship machinery, its construction and manipulation; a hand and reference book for marine engineers, officers of men-of-war and merchant steamers, machinists, students, ship builders, and others interested in marine engineering. There are two volumes of text and one volume containing 170 lithographic plates, comprising 1,300 colored figures taken from the working drawings. The publishers are Lipsius & Tischer, of Kiel, Germany. This exhaustive work appears now in an enlarged second edition, and comprises every machine used on board of men-of-war and merchant steamers, and, in point of completeness, outrivals any work of like nature ever published. It is not a dry compilation of statistical results, nor a history of ship machines; but it gives in concise language the physical laws governing the construction of machines, the mathematical formulæ derived from these laws, and a full and complete description of the construction and arrangement, with the resultant operation and details, of every machine on board of a steamer. It is needless to say that the author has selected, from every type of ship machine, the most advanced, standard styles. The various tables contain comparisons of the use of coal and steam, strength of parts, the relative proportions of French, German, and English men-of-war, etc. The plates, which are bound in a separate volume, are magnificently executed, the sections being colored according to the colors of the respective materials, and every figure is drawn to a scale. The work is handsomely bound, and the publishers deserve great credit for the manner and style in which they have presented the work to the public. The author, C. Busley, Professor in the Imperial Marine Academy in Kiel, has again proved that German savants deserve the reputation which they enjoy for thoroughness, deep study, and completeness of thought, and last, but not least, for being thoroughly wide awake to the requirements of modern times.

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.

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) T. D. McC. asks: 1. For what kinds of work is the diamond carbon battery suitable? A. For intermittent or open circuit work only. 2. Can electric light carbons be used in its construction? A. Yes.

(2) P. J. McC. asks the reasoning by which the following algebraic expression is reached. The age of a father is represented by a, the age of his son by b. The problem is to deduce a formula for determining the space of time (in years) in which the age of the father will be n times that of the son. The solution is $\frac{a-nb}{n-1}$ years. How is it deduced? A. Starting with the father, aged a years, and the son, aged b years, as time advances the same increment is added to each age. Call this increment x. The ratio of age to age, or the quantity n, depends upon this factor. After the expiration of any given time x, the ratio of the ages will be denoted by $\frac{a+x}{b+x}$. This by the conditions of the problem is equal to n, giving us the equation

$$n=\frac{a+x}{b+x}$$

which reduces to

$$a+x=nb+nx$$

and solved with respect to x gives

$$x=\frac{a-nb}{n-1}$$

(3) G. A. B. asks: Would not cypress be a far better wood to use for stringers and ties for street car tracks than either white or yellow pine? A. No. Cypress is more durable in damp places than pine and is stronger, but it has the serious disadvantage of springing in its length, which renders it unfit for car track stringers, although some varieties are free from this objection, and could be used for the purpose. The cost of cypress is about one-third higher than pine, which is in itself a drawback to its use.

(4) H. A. asks (1) what process there is of fixing a billiard ball which has a small piece chipped out. A. Use white mastic 30 parts, shellac 90 parts, turpentine 6 parts, and spirit of wine 90 per cent strong 350 parts. Use as a cement. 2. Also of changing white to a dark red. A. Soak in a solution of aniline red, which should be very slowly heated to near the boiling point. 3. How far does a rivet on the circumference of a wheel, whose diameter is six feet, travel in a lane a mile long? A. The cycloidal path followed by the rivet measures 6,722$\frac{4}{11}$ feet, about.

(5) C. E. K.—The 20 ohm sounder with three cells should give slightly better results, as regards sound.

(6) J. F. H. asks (1) how far the Panama Canal is completed. A. No portion of the canal is fully completed. 2. What chemicals are used for coating dry plates? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 541, for full particulars.

(7) W. K. D. asks if fish are ever frozen up in ice and transported alive in that condition by the Government Fish Commissioners or by any one? A. The Fish Commission have never used this method of transportation of live fish; freezing kills them. Commissioner Blackford says the assertion that this has

been done is derived from somebody's unattested experiment, and is entirely impracticable. 2. If a cannon be placed in an exact vertical position and a ball fired therefrom, would the ball fall back into the cannon's mouth, or where probably? A. The ball will fall ahead of the cannon in the direction of terrestrial motion, according to an answer recently given by *Knowledge*.

(8) J. A. L. asks: How many cells of Leclanche battery will be required to operate one 8 candle power incandescent lamp? Will an increased number of lamps require an increase in the number of cells? Will it require twice as many cells for a 16 candle power lamp as for an 8 candle power? A. It will take about 50 cells of the best Leclanche battery without porous cup. The more lamps the more cells will be needed. For a 16 candle lamp about double the number would answer. They would only light the lamp for a very short period before weakening and needing rest. The proper battery is a large bichromate battery.

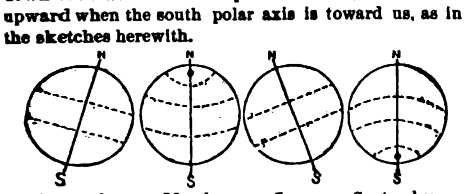
(9) J. G. & Co. write: A party has had in use for some time a Ball electric light dynamo, 20 light machine, driven with two 3½ inch belts from pulleys on each end of dynamo, 18 inches diameter. He is advised to abandon the use of one belt, on the ground that a single belt is ample and that dynamo will run better and not use any more power. He thinks such advice is more in the interests of the owner of the dynamo to secure a steady light regardless of power and life of machine, as it was constructed to be used with two belts, which view is correct? A. We think two belts preferable to one of the same width, as they can be run looser than a single belt of the same size. By the use of two belts the strain is divided between the two journals. The difference between driving dynamos coupled and separated is little or nothing.

(10) W. S. B. asks for a soldering mixture which can be used to solder the terminals of the platinum wire in an incandescent electric light with the copper wires which connect with the dynamo, so that the heat from the platinum wire will not melt the solder. A. A galvanic soldering of copper would probably answer. If the copper wire is of sufficient size, we think ordinary silver solder with borax would do.

(11) J. S. asks how to make a good strong dry sand core for iron moulding, something that can easily be handled without breaking and will come out of the casting easy and without much trouble. A. Dry sand cores for iron castings are usually made with new sand with as little flour paste as will make the core hold together. The less paste, the easier the core is drawn out. Bake the core in an oven, dry enough to brown the surface, but not hot enough to weaken the paste.

(12) T. S. M. asks: What proportion of the water from a spring would a common hydraulic ram raise to a height of fifteen feet, with a fall of three feet, and is it practicable to use a ram with only three feet of fall? Will water flow through a small pipe as fast in proportion to its size as through a large one, or is there not more friction in the small pipe? A. Your ram will utilize about one-fifth the water flowing through the supply pipe. Supply pipe should be from five to ten times the fall, in length, and of a size suitable for the size of the ram. A large pipe has less friction in proportion to its area than a small pipe.

(13) W. V. R. asks a short description of the motion of the sun spots across the surface of the sun, as seen from the earth. A. The sun's axis being inclined to the ecliptic, the sun spots at different times in the year move in a direct line, inclined upward or downward equal to the inclination of the solar axis; while at intermediate times they follow a curved line, downward when the north polar axis is toward us or upward when the south polar axis is toward us, as in the sketches herewith.



December. March. June. September.

(14) C. F. H. asks how to make phosphorized oil. A. Phosphorus is soluble in any of the fixed oils. Dissolve it in the proportion of 24 grains to the ounce, say of cottonseed or olive oil.

(15) D. E. M. asks: Can I make a motor of the same style as dynamo "Siemens," described in SUPPLEMENT, No. 161, of sufficient strength to run a velocipede carrying two persons, and how many cells of the Grenet battery are needed? A. The motor you refer to would not run such a velocipede. You would need about 100 Grenet cells to give you one man power in the outer circuit.

(16) A. Y. C. asks: 1. Why cannot compressed air be used as a motor for light vehicles? A. It is too bulky, and requires too heavy reservoirs to sustain the pressure. It also cools on expansion, thereby involving a loss of power. 2. If it can, could not compression be effected by windmill power in portable boxes, to be placed in the vehicles? A. It could. 3. What would by the weight and dimensions of a box of best material to contain enough air, say of 20 atmospheres, to propel a light carriage to contain two persons, making 6 miles an hour for 8 hours, over an average good road? A. An average of one horse power for 8 hours could be maintained by a cylinder about 100 in. long and 30 in. diameter, filled with air compressed as you describe. The cylinder should be at the lowest estimate, if of steel, three-tenths inch thick. The power would continually run down, of course. 4. How is the "lethal chamber" constructed for the "painless removal" of animals, as I have some dogs I wish to get rid of? A. Put the dog in a tight box, with a saucer full of chloroform, or invert a tight box over him and fill it with coal gas. Have no lamp or fire near, for fear of a conflagration. See SUPPLEMENT 476.

(17) H. D. R. asks how to polish geological specimens, such as coral, onyx, jasper, and other minerals. A. For amateur work, an ordinary grindstone answers the purpose of grinding a facet or surface for showing the texture or crystallization of minerals and geological specimens. For ease of polishing, make the surfaces slightly curved. A piece of sole leather drawn and nailed to a board makes a good finisher, using pulverized pumice stone and water on the leather. A piece of felt or heavy woolen cloth, tacked on a board, also makes a good polisher. Use for polishing, oxide of tin, called putty powder by the marble workers. Apply it wet with water to the cloth, so as to saturate the cloth with the creamy mixture. With these crude appliances and plenty of muscle the amateur will develop the characteristics of ordinary specimens.

(18) J. P. S. asks how the preparation known as "beef, iron, and wine" is manufactured. A.

Liebig's extract of beef....	½ oz. avds.
Ammonio-citrate of iron....	256 grains.
Spirit of orange (1-10).....	½ fluid oz.
Water....	1½ " "
Sherry wine, enough to make...	16 " "

Dissolve the extract of beef in the wine, add the spirit of orange, dissolve the ammonio-citrate of iron in the water, and mix the solutions.

(19) Acoustic.—There is but very little sound produced by the string alone in a violin, which you can prove by holding a violin string in a vise and stretching it with the hand, drawing the bow. It is the vibrating sounding board that gives volume and tone.

(20) A. D., of East Orange, N. J., writes: We have at this place a fire alarm, consisting of a 5½ foot tire (steel) of a locomotive driving wheel. It is suspended in a tower and rung with a hammer operated from the ground. It does not sound as loud as is desired, and I would like to know whether the volume of sound can be increased by cutting a piece from the tire. A. The sound of the steel tire will have a much larger volume at a lower tone by cutting. It need be cut only once across, and slightly opened by springing. Find the best point for striking the tire by its tone at different points.

(21) J. C. R. asks a good formula for a blue lacquer, such as is used on watch springs, etc. A. Watch springs are blued by heat. You may make a blue lacquer by coloring shellac varnish, made thin with 95 per cent alcohol, with indigo blue or smalt blue.

(22) J. B. asks: 1. A recipe for polishing gun stocks, in which neither varnish nor shellac appears, as they are not allowed. A. Mix boiled linseed oil and turpentine, equal parts, for a polish. Rub the gun stock with a piece of paraffine or clear beeswax. Then rub the stock with a few drops of the polish on a woolen cloth to a smooth surface, and brighten with a dry cloth. 2. How can lead be silvered? A. By electro-plating, making the anode about three times that required for German silver, and the battery power strong, but not too intense. Let there be a good deal of free cyanide in solution.

(23) G. S. asks what is good to put in a tumbling barrel to polish brass and zinc, and how is oxidizing done on brass? A. Sawdust and pulverized charcoal are used. Also leather skivings and charcoal. Oxidize brass by exposing for a few minutes to the fumes of sulphur in a close box.

(24) R. S. asks: Is water compressible? For a long time liquids were regarded as being incompressible, but since then researches have been made on this subject by several physicists, and their results have shown that liquids are really compressible. In Ganot's Physics, in the chapter on Hydrostatics will be found an interesting account of the method of determining the compressibility of a liquid by means of an apparatus called a piezometer. Water experiences a compression of 0·00005 part of its original volume. The compressibility of sea water is only about 0·000044; it is not materially denser, even at great depths; thus at the depth of a mile its density would only be about one one-hundred-and-thirtieth greater. For water and mercury it was also found that within certain limits the decrease of volume is proportional to the pressure.

(25) J. A. W. asks: I have an old relay; it is wound to 240 ohms resistance. Can the same (the coils) be used as a motor for small power, such as toys, etc.? (I should say it was wound with No. 34 wire.) If so, how many cells of (one gallon cells) improved automatic battery (bichromate of potash and sulphuric acid) would it require to run it? There is a white substance that creeps over top of my gravity battery jars. What is it, and what use can I put it to? What is the cheapest battery for running a small motor, say for sewing machine? A. The resistance of the coils is very high for a motor; in general terms, the more cells you use, the better. Small cells and numerous ones are better for your case than a few large ones. The white substance is sulphate of zinc; it is useful as a disinfectant, but is highly poisonous. For a motor, a large bichromate battery is, all things considered, the best.

(26) F. W. K.—If the earth should cease revolving, it would slightly change its form, and become a perfect globe, when gravity on the surface at the equator would be somewhat greater than now. As it is, a given weight at the equator weighs more at the poles, as is shown by the increased beat of a pendulum of fixed length.

(27) C. R. asks: 1. How can I make cotton cloth, such as American drill, calico, etc., waterproof without painting, or having to spread anything on it that would damage its texture or softness? A. See the articles on this subject contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 58 and 317. 2. There is a freezing mixture composed of sal-ammonia, saltpeter, and common soda. Can you give me the formula? A. Take 8 parts of sulphate of soda, 5 parts each of sal-ammonia and saltpeter. When about to use, add double the weight of all the ingredients in water.

(28) B. & G. ask: Is there any preparation which will prevent flies and other insects from lighting on and specking windows, etc.? A. Make a strong infusion by boiling smartweed for a few minutes in water. When cold apply it to the glass, and for twenty-four hours it is quite effectual in keeping away flies and insects.

(29) M. F. S. asks: What will make a durable gold wash for a watch? A. Any gold wash or plating powder is less durable than electro-gilding, and that wears only according to the thickness of the deposit. You might try the following: Wash thoroughly one-fourth ounce chloride of gold, then add it to a solution of two ounces cyanide of potassium in a pint of clean rain water; shake well, and let it stand until the chloride is dissolved. Add one pound prepared Spanish whiting, expose to the air till dry, and then make into a paste. In applying, rub it on the surface of the article with a piece of chamois skin or cotton flannel. The surface of the article should be thoroughly cleansed before applying the plating powder.

(30) J. W. asks: 1. Will you give formula for waxing meerschaum pipes, and the process for boiling? A. The bowls of the pipes, when imported into Germany, are prepared for sale by soaking them first in tallow, then in wax, and finally by polishing them with share grass. The coloring process as conducted by dealers is secret. 2. How can the coloring for pipes be made to cover the entire pipe? A. This is performed by a secret process, probably using some solvent of nicotine. 3. Is there such a thing as burning meerschaum by smoking? A. Yes.

(31) G. W. C. asks how to make stain for the soles of fine shoes after they have been buffed? A. The most common method of making a red sole look somewhat like oak leather is to damp with a mixture of borax and oxalic acid, made in a rather strong solution, and when nearly dry apply white bottom balls or French chalk; a little chrome yellow is also sometimes used in addition to the above. Many manufacturers have special stains, intended to be more durable, and to counteract the effect of acids used in making some kinds of sole leather.

(32) E. H. R. asks the average per cent of gain in compounding the engine, or what it would be in a 9×12×15 at 100 pounds steam and 26 inches vacuum, cutting off ¼ stroke. A. 15 to 50 per cent, according to perfection of appliance.

(33) J. O. S. asks: How can I polish or varnish piano legs that have become dingy? A. To do such work well is laborious. Clean and smooth the surface well with rotten stone on a wet woolen rag, and follow with vigorous work with a chamois skin. Then to 2 ounces of melted white or yellow wax add 4 ounces turpentine, and give a good covering coat.

(34) M. H. M., Kentucky, asks: What will take burnt grease off of a boiler? A. If the boiler is brass or copper, use oxalic acid.

(35) S. T. S., Newark, N. J., asks: 1. Why does metal, a needle for instance, broken off in in the flesh, travel to different parts of the body? A. Its movement is due to muscular contraction, produced by various causes and influenced by local conditions. 2. Are the American people, as a rule, thinner than the English or German, and if so, how do you account for it? A. They are said to be so, and it is probably the result of the climate. Nervous people are apt to be thinner than others, and the typical American is thin. 3. Please state average weight of English, American, Scotch, German, and Irish people. A. There is no data obtainable to answer such a question.

(36) Miss M. M. G. asks how to make bretzels. A. Take of flour ½ pound, fresh butter ½ pound, sugar ¼ pound, add one whole egg, one yelk of egg, some grated lemon peel, and a tablespoonful of sweet cream. Mix thoroughly on a paste board, and mould this paste into bretzels or small wreaths, wash them over with the yelk of an egg, strew them with pounded sweet almonds, and bake to a nice yellow color on a baking plate larded with butter.

(37) J. B. J.—If you desire a darker hair dye than that for which we gave a receipt December 25, use an increased amount of silver nitrate and less of the copper. Experience shows that the dye given produces excellent results.

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