SCIENTIFIC AMERICAN

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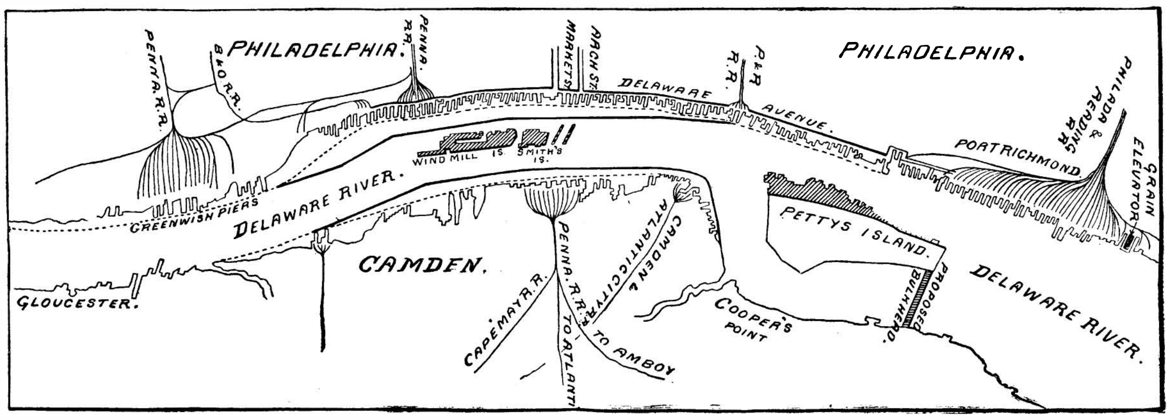
THE OBSTRUCTIONS IN THE DELAWARE.

The constantly growing commerce of the port of Philadelphia has, in recent years, forcibly attracted the attention of the national, State, and municipal governments, and the various commercial bodies of the city, to the limited facilities for docking vessels and the fact that the condition of the harbor was becoming worse, instead of improving.

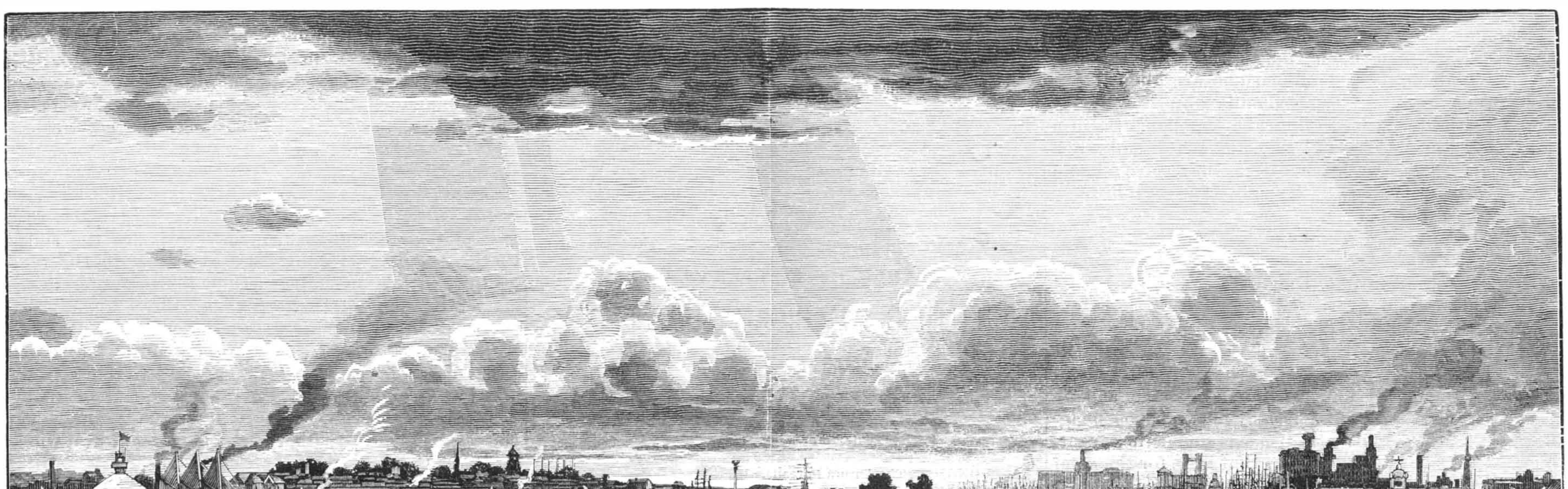
The obstructions to navigation in the Delaware River, opposite the city, are well known to those who have occasion to use the river, and the many attempts to improve the channel have met with little or no success. The greatest obstruction exists at Smith's and Windmill Islands, yet the real cause of all the trouble lies further up the river, at Petty's Island, the northern extremity of which serves to direct the full force of the ebb tide toward the Jersey shore at that point, and coursing down around Cooper's Point, and across the river from this abutment, makes a very deep but narrow channel contiguous to the Philadelphia piers; and the strength of this rush of water serves to build up the bars north of Smith's and Windmill Islands to a most serious extent, and these bars are most rapidly growing with the daily action of the ebb tide.

Some years ago, a dike was built at Petty's Island to change the course of the tide, but the result was directly opposite to that desired, and in consequence the island extended rapidly to an alarming degree. The new channel built at the same time for the Market Street ferries was another failure, and can be kept open only by means of constant dredging. It is only a question of time when Petty's and Smith's Islands would be joined into one, so rapid is the growth of the bars between them, and this fact is so patent that all parties interested joined in a petition to the United States government to buy and remove the two lower islands.

"The removal of the islands is not the only question involved in the matter. In order to prevent the formation of new shoals, it will be necessary to remove the cause of the trouble. The real remedy lies in the prevention of the funnel action of Petty's Island in driving the ebb tide toward the Jersey shore. This can only be effected by constructing a breakwater from the



IMPROVEMENTS IN THE DELAWARE RIVER.



WINDMILL AND SMITH'S ISLANDS, TO BE REMOVED TO OPEN CHANNEL IN DELAWARE RIVER.

upper end of Petty's Island across to the New Jersey side, completely closing the upper end of the eastern channel and compelling the entire current to pass down on the Philadelphia side. The action of the current, under these circumstances, would be to round off the lower end of Petty's Island and also to distribute the force of the ebb tide more uniformly over the river. This, in connection with the removal of the islands, would undoubtedly remove both the obstructions and their cause, and give Philadelphia once more a harbor.

"There is another matter of much importance also connected with the improvement of the river, viz., the extension of the port warden's line out into the river, narrowing the channel and giving increased length of piers.

"Even if the harbor permitted the arrival of ocean steamers," says *Mechanics* in a recent article, "there are no piers of sufficient length to receive them. Vessels are constantly increasing in length and the piers should be lengthened in proportion, and, if the obstructions are removed, as indicated above, the extension of the line on both sides of the river would produce a channel of sufficient width and reasonable uniform depth. On the Philadelphia side this line should come out about 500 feet, and on the New Jersey side about 400 feet, thus providing ample room for docking vessels of the largest tonnage anywhere along the river front, from one extreme to the other."

A number of gentlemen representing the city councils, the various railroads, the Chamber of Commerce, Board of Trade, Maritime Exchange, harbor commissioners, port wardens, and elevator companies, made several visits to Washington and conferred with the House Committee on Rivers and Harbors. The above bodies were re-enforced by a committee from the Camden City Council. Congressman Randall at length had a bill passed which was considered satisfactory by the commercial and other bodies interested, and the government has appropriated large sums of money for the purchase and removal of the two lower islands and a considerable slice of Petty's Island. This done, the port warden's lines on both sides of the river will be extended, as suggested in a foregoing paragraph, thus giving docking facilities hitherto unknown, and admitting of a considerable widening of that crowded street on the Philadelphia side known as Delaware Avenue.

In addition to the money appropriated by the general government, considerable sums are about to be given by the States of Pennsylvania and New Jersey and the cities of Philadelphia and Camden. So in a very short while work will be commenced, and when completed, Philadelphia commerce will receive a boom that has been long held back solely on account of these existing obstructions.

Perpetual Motion Again.

Until a few days ago, the inventors of perpetual motion have been prevented from completing their application for letters patent in the United States by the skillful manipulation of one of the rules of the office. The Receiver-General has the power to demand a working model of any apparatus before it can be protected by a patent, and it may naturally be imagined that no such apparatus has ever made its appearance. But we have changed all that now, for the chief clerk of the Patent Office in Washington has declared publicly that perpetual motion was an "assured fact, and that at the present time there are now in the Patent Office machines which have sufficient power to run themselves from now till doomsday," and that "a machine with surplus power for the running of other machinery will come some day, and may come at any time." The American newspapers express their anxiety as to whether the practical management of the Patent Office depends to any great extent upon the chief clerk. —*Industries.*

Our excellent British contemporary is usually very correct, but has somehow fallen into several little errors in the above item. There is no such officer as the Receiver-General connected with the American Patent Office. The chief clerk of the Patent Office in Washington has not publicly declared that perpetual motion was an assured fact; he has not stated that at the present time there are in the Patent Office machines which have sufficient power to run themselves from now until doomsday. The American newspapers have not expressed any especial anxiety concerning the chief clerk. He is a gentleman of well known ability, highly esteemed and respected by everybody. The management of the Patent Office is in the hands of the Commissioner of Patents.

Thick Mortar in Brickwork.

G. D. Dempsey, in the *Architect*, London, says: One important rule has to be observed in order to produce good brickwork, viz., that the mortar should be as thick as it may be, or as nearly approaching the solid form as is consistent with the degree of plasticity essential for its proper distribution and penetration into the joints, while the bricks should be thoroughly wetted on the surface. By these means the adhesion between them is rendered the more perfect, and the subsequent amount of shrinking and settlement is reduced to a minimum.

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(Illustrated articles are marked with an asterisk.)

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No. 689.

For the Week Ending March 16, 1889.

Price 10 cents. For sale by all newsdealers.

NAVAL AND MARITIME PROSPECTS UNDER THE NEW ADMINISTRATION.

On the 4th of March the official term of Grover Cleveland as President expired, and the new President, Benjamin Harrison, of Indiana, was inaugurated. He is fifty-six years of age, a man of marked ability and the highest probity. It is gratifying to know that the improvement of the navy, which was so vigorously prosecuted during President Cleveland's administration, is to be continued under the new *regime.* In his inaugural address, President Harrison says:

"The construction of a sufficient number of modern war ships and of their necessary armament should progress as rapidly as is consistent with care and perfection in plans and workmanship. The spirit, courage, and skill of our naval officers and seamen have many times in our history given to weak ships and inefficient guns a rating greatly beyond that of the naval list. That they will again do so upon occasion I do not doubt, but they ought not by premeditation or neglect to be left to the risks and exigences of an unequal combat.

"We should encourage the establishment of American steamship lines. The exchanges of commerce demand stated, reliable, and rapid means of communication, and, until these are provided, the development of our trade with the States lying south of us is impossible."

NAVAL WAR OF THE FUTURE.

In his second paper on "The Naval War of the Future," Admiral Porter, for purposes of illustration, imagines a war as existing between Great Britain and France, and a great expeditionary force on the French coast only waiting a successful issue of a combat between the Channel fleets of the two powers to set out for the invasion of England. Into this combat the Admiral brings what are thought to be the best ships of both sides, and other types of war engines which European authorities incline to look upon as most effective. If the behavior of these monsters is fairly drawn, those who believe we are poorly off without them will have been properly answered; it will appear that these and other powers have for years been wasting energy and money, and indeed some may even be so bold as to see in the picture which the Admiral himself gives us, good circumstantial evidence of how unreasonable is that regret, which he expresses more than once, that we have not been similarly occupied.

Instead of making for the Frenchman as of old, the British are portrayed as waiting for him to come up, a sort of pounding match ensuing in which those engaged are not more likely to hit the enemy than to run foul of their neighbors, so awkward are the ships in the Channel's rolling seas, so uncertain the aim of their ponderous guns. While the opposing monsters are struggling to keep their spirits up, several speedy little craft flying the English flag run athwart the advancing French line, and then disappear in the cloud of powder smoke that hangs upon the waters. The French do not know what to make of the maneuver till a number of their ships drift helplessly here and there, their screws tied fast in the mesh of iron wires left buoyed up by the mysterious little vessels. Then a mite of a torpedo boat jams a spar torpedo against the biggest of the enemy's ships and blows her up. She was prepared to pierce 20 inches of steel armor, but not for the mouse gnawing a match in her magazine. The only effective work is done by the torpedo boats and similar mischievous craft, the result of the contest being the withdrawal of both fleets.

Curiously enough, the Admiral, after a lengthy description of his supposititious sea fight—the impotency of the modern line-of-battle ship becoming more evident as he proceeds—when, indeed, he has fairly demonstrated that the smaller and more quickly handled gun is more effective than the really heavy gun, he suddenly turns about to declare: "We could, if we would, soon be equal to the best of European navies in line-of-battle ships and heavy guns." His subsequent allegation that "there is not one perfect line-of-battle ship in any navy" would seem to do as little to recommend the new type he presumably has in mind as that now in vogue, for of what value would his "perfect" line-of-battle ship be to us, if only to "make us equal" to that European ship which, if the picture he draws for us may be relied on, is manifestly impotent? He says:

"In the naval wars of the future, the United States will not, probably, play a conspicuous part. This country seems to possess none of that fitness for naval power of which her early history gave promise. The United States government waited twenty years after the close of the civil war before commencing to rehabilitate the navy, on the plea that 'it was desirable to see what the powers of Europe were going to do,' apparently not remembering that the best steam and sail vessels of the world were the results of American genius in the days when it took the initiative. Americans have abdicated the position which their vast resources entitle them to hold."

Then he goes on to describe the operations of the British fleet under Admiral Seymour against the defenses of Alexandria, and thus concludes: "Every naval officer will admit that the old wooden line-of-battle ships of the Trafalgar and Wellington class would have silenced the forts in an hour with little damage to themselves. If the Egyptian shells had been charged with dynamite, all would have been changed."

Thus it would appear that the modern fleet has not fulfilled its promise, while the dynamite principle, as applied to projectiles—a principle, be it said, which so far has seen its highest development in America—is commended by the most distinguished authorities, among them the chief officer of our navy. That being the case, it would seem as though we could not have been idle to more advantage in the one direction or used our energies to better purpose in the other.

For further proof of this, we may turn to the Admiral's paper. He finds reason to believe that two or three small crafts armed with long range dynamite shell guns would be more than a match for the most powerful armorclad ship afloat. There's the Graydon gun, which the Admiral recommends so highly. How would one of these great ships fare if opposed to it? At a recent experiment with a 7 inch Ames wrought iron muzzle-loading rifle weighing 23,000 lb., powder 23 lb., a projectile weighing 122 lb. charged with 2⅔ lb. dynamite was fired at a 7 inch iron turret; the explosion of contact lifting the turret, weighing 30,900 lb., and carrying it 25 feet by actual measurement, the plates being torn violently apart.

The Zalinski gun is yet, in the opinion of the Admiral, of insufficient range, but he believes it will yet become another important factor in naval war.

From all this it is seen that, however unwise the policy of waiting may be when regarded as an abstract proposition, its adoption, at least in the present case, would seem to have been fortunate. At the breaking out of the civil war in 1861, the effective power of our fleet was small. In four years' time it was the most powerful in the world, even the British steam fleet, only a few years before acknowledged to be the best equipped on the ocean, being compelled to take second place because of the introduction of naval armor of Yankee designing.

PROPOSED INCREASE OF THE BRITISH NAVY.

The intentions of the English government with regard to the navy have recently been formulated by the First Lord of the Admiralty before Parliament. It is proposed to build eight first-class men-of-war, of 14,000 tons each, and two of 9,000 tons, besides nine first-class cruisers and twenty-nine smaller vessels. A total tonnage of 318,000 is represented, and a cost of about one hundred millions of dollars is predicated. Four and a half years are allowed for carrying out the programme. The work, it is proposed, shall be divided between the government ship yards and private firms. The recent accessions to the navy of France and of America are probably among the incentives to this action. Formerly the United States, by their isolated position, felt to a considerable extent exempt from the necessity of entering into competition with other powers in the matter of armament. It is to be hoped that a race for nominal supremacy on the sea shall not be participated in by this country. The construction and maintenance of useless ironclads is only a degree removed from the almost intolerable burden of a standing army. It is really to be hoped that the improvement of ordnance will make these expensive and useless ships as extinct in naval warfare as personal armor is in land fighting. Then passenger ships could be pressed into service if needed. Apart from this, the proposal is a very impressive one. The ships will compare in tonnage with the Great Eastern, and will be the precursors of fleets that will dwarf all existing craft from their number and weight. This is certain to ensue, because the other great nations will follow in the lead of England. Yet the hope is expressed by the government that other powers will not attempt to rival England, as she has not attempted to rival them in her land forces. This reads like an apology for so immense a demand, but it is to be feared that the Continental powers will not see it in that light. If carried out, it probably will mean increased expenditure of national revenues by all nations, so that England's hundred millions will be but a fraction of the useless expense that will be lavished on the world's destructive navies.

A RIVAL FOR JUTE.

One of the characteristic features of the industrial discoveries and inventions of the day is the development of new fibers. Jute, for many years, has held a prominent place, and has acquired such importance that it has come to be looked upon as a necessity. A combination of manufacturers and dealers have, to a great extent, controlled the market, but now it is said that the pine needle has proved sharp enough to prick some very serious holes in the trust. Unquestionably the pine needles contain a fiber, but the problem of economically extracting it without impairing its length or tenacity was hard to solve. A typical patent is one granted to William Latimer, of Wilmington, N. C. He proposes to utilize the fiber principally for the manufacture of bags for inclosing cotton bales. As a material for the latter purpose, jute has long reigned supreme. The treatment of the "needles" is a simple one. The outer coating of the leaves is silicious in composition, while the inner parts are resinous and pulpy. Hence Mr. Latimer proposes to energetically attack and destroy the outer coating first, and then to apply a more moderate treatment to the easily disposed of chlorophyl and resin of the inner portions of the leaf.

The needles, preferably green, are placed in a tank, and are pressed down by a grating and screw against its bottom, so as to be tightly compacted. A solution of caustic soda of three per cent or four per cent strength is then introduced, until the mass is about covered. Steam is then turned on, and the temperature kept at 212 degrees Fahrenheit for ten or fifteen minutes. A head of foam forms on the solution, which is accepted as the index of the completion of the first step. The screw is now loosened, and the solution, which contains considerable silicate of soda, is allowed to act upon the leaves for about ten hours, the temperature varying from 208 deg. to 70 deg. Fahr. The gummy and resinous matters are saponified, and the fiber is left uninjured as regards length of staple or tenacity. The soda solution is run off, and the fibers are washed repeatedly with clear water at various degrees of heat. After this the fiber is ready for mechanical treatment by regular processes. In the successive washings the temperature is reduced step by step, but never is allowed to fall below 70 degrees Fahrenheit. This is thought to favor the production of a clean fiber.

It is interesting to think that in her pine forests the South has ever growing the fiber for her cotton bales, and we hope the process may attain a wide application.

THE CELESTIAL WORLD.

THE OCCULTATION OF JUPITER.

There will be an occultation of Jupiter by the moon on the morning of the 24th. The occultation will be visible in Washington, though the sunlight will greatly interfere with the observation. The immersion of the planet takes place at 6 h. 42 A. M., and the emersion takes place at 7 h. 43 m. A. M. in standard time at Washington. The occultation continues 1 h. 1 m. The sun rises on the 24th at 5 h. 42 m. A. M., and the occultation commences an hour after sunrise.

The moon at that time has just entered upon her last quarter, and is near the meridian. She may be easily found as a half moon, taking on the cloud-like aspect that marks her appearance in daylight. Jupiter is now bright enough to be seen with the naked eye in full sunlight, but it is a difficult matter to find him, and requires exceptional visual power. Keen-eyed observers may succeed in picking him up as a cloudy point a little further south than the moon, if they begin to look a short time before the occultation. They will see him apparently approach the moon, disappear behind her bright limb, and reappear after an hour's absence, from behind her dark limb, or where it would be, if it were not hidden in the sunshine.

The time and continuance of the occultation are given for Washington. They will differ in other localities where the phenomenon occurs, on account of the parallax of the moon. In Providence, R. I., the immersion of the planet takes place at 6 h. 55 m. A. M., and the emersion takes place at 7 h. 50 m. A. M., standard time, the occultation continuing 55 m. The difference is due to the different direction of the moon when seen from two different points like Washington and Providence.

An occultation of Jupiter is a sight worth seeing, even in the daytime. It is infinitely more interesting if it occurs when the sun is below the horizon, and can be observed in a powerful telescope. If the moon be then passing from the full to new, the Prince of Planets, nearly as large as the moon to the unaided eye, seems to plunge headlong beneath the moon's bright limb, and reappear when the occultation is over beyond the moon's dark limb with the suddenness of a new creation starting from the sky depths. An opera glass will be a valuable aid to observers of the occultation of the 24th, and a telescope will bring out the picture with marvelous effect.

Jupiter is occulted nine times during the year, but only two of the occultations are visible at Washington—one on the 24th and the other on September 3.

Observers should prepare themselves for the occultation by a view of the charming morning star and the moon before the dawn in the southeast, in order to fix in the mind their relative position and place in the heavens.

How Many Minutes Have Passed at the End of the Year 1888, Calculating from the Beginning of the Christian Era?

This question has recently been answered in an interesting article published in a German journal, the Munich *Neueste Nachrichten*, with the surprising result that not a milliard minutes have passed. The calculation is as follows: 1888 multiplied by 365 days equals 689,120 days, to which must be added 460 leap days, making a total of 689,580 days, which contain 16,549,920 hours, or 992,995,200 minutes, that is 7,004,800 minutes less than a milliard.

The milliard minutes will be reached in the year 1902, on the 28th of April, at 10:40 A.M.

Taking in consideration that the indemnity paid by France to Germany after the war of 1870–71 amounted to 5 milliard francs, it follows that if this sum were to be paid at the rate of 5 francs (about $1.00) for every minute since the beginning of the Christian era up to date, that sum would not have been paid yet at the present time.—*T. G. H.*

Newspaper Notes.

Mr. Moses Y. Beach, of this city, has lately become the editor and proprietor of the Berkshire County *Eagle*, published at Pittsfield, Mass. Mr. Beach is a grandson of the late Moses Y. Beach, formerly of Springfield, Mass., afterward widely known as the enterprising proprietor of the New York *Sun*.

Mr. Beach, of the *Eagle*, is a native of Connecticut. Although quite a young man, he has had much newspaper experience, having served several years on the *Graphic* and other papers, and for the past six years on the New York *Tribune*. He "can boast of a high ancestral name," being a lineal descendant of Elder William Brewster, who came over in the Mayflower, and of Elihu Yale, founder of Yale University.

The *Eagle* is one of the ablest newspapers in Western Massachusetts, and perhaps the oldest. It was established in 1789, one hundred years ago, the year Washington became President.

The first newspaper in America was the Boston *News Letter*, which was first issued by John Campbell on Monday, April 24, 1704; it was regularly published for nearly seventy-two years. The second was the Boston *Gazette*, begun December 21, 1719. The third was the *American Weekly Mercury*, issued in Philadelphia on December 22, 1719. James Franklin, an elder brother of Benjamin, established the New England *Courant*, August 17, 1721.

The first steam printing press for newspapers was that used on the *London Times*, November 28, 1814.

Sir William Pearce.

The recent death of Sir William Pearce, in his 56th year, arrests in his career one of the most eminent engineers of naval constructions of our epoch. Sir William was born at Brompton, England, on the 8th of January, 1833. After his studies at the government school at Chatham, he was, although still a young man, selected by the Admiralty to superintend the construction of the Achilles, the first iron ship built at the government dockyards.

Later on he assumed the direction of the Napier dockyards, on the Clyde, where he obtained a brilliant renown. A few years afterward (in 1870) he took possession of an important station at Fairfield, where, in concert with the near relatives of Mr. John Elder, he continued and developed the famous house of John Elder & Co., of which he became the head in 1878.

It was at this epoch that he conceived those grand plans for the construction of packets with which his name has remained associated.

Under his direct supervision, there were constructed in his shipyards a number of vessels of more than 200,000 tons burden, and of nearly 300,000 H. P., for a sum exceeding $35,000,000.

The first of the series of transatlantic vessels was the Arizona, built for the Guion line. This was followed by the Alaska and the Oregon, whose speed was exceeded only by that of the Umbria, which, with a few important modifications, was of the same model.

Nearly at the same epoch he built the North German Lloyds' fleet, consisting of ten magnificent packets. Afterward came the New Zealand Shipping Company's fleet, whose success is well known, and which reduced the distance of the antipodes to 36 days from England, and of Sydney to 38 days from Plymouth.

In the construction of vessels of less size than those cited above, Sir William was no less successful. It is, in fact, due to him that the passage from Dover to Calais can be, for the first time, effected in less than an hour.

His great technical knowledge, activity, and remarkable energy, and his ability to distinguish capable men, permitted him to establish the vastest shipyards in the world.

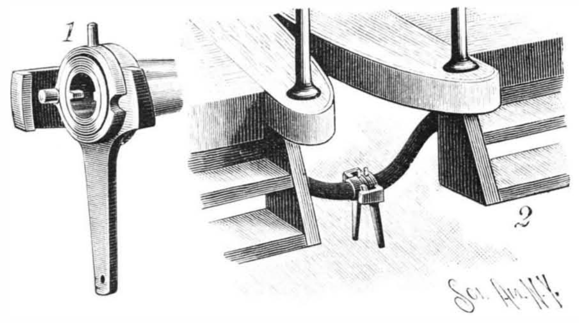
The extraordinary rapidity with which he built a 5,000 ton steamer—in the incredible space of 98 days—will long be remembered.

It was likewise due to his great energy and to the remarkable organization of his establishments that, at the time of the Soudan war, he built, in 28 days, 11 stern-wheel vessels for the navigation of the Nile, and that he was enabled to deliver them at Alexandria two days before the expiration of the contract. It was for the same destination, too, that he constructed a hospital boat in the space of 21 days—a feat that procured for him the earnest felicitations and thanks of Lord Hartington, then minister of war.

Sir William was elected a member of Parliament in 1885, and was made a baronet in 1887.

AN IMPROVED PIPE COUPLING.

A pipe coupling designed for use for steam heating purposes, air brakes, water hose, etc., has been patented by Mr. William M. Darrow, of Salem, N. Y., and is illustrated herewith, Fig. 1 showing one of the halves of the coupling. The coupling is formed of two sleeves, each with a recessed flange, and cam levers adapted to embrace the flanged sleeves and interlock. The flanges each have a stud which fits into a notch in the edge of the opposite flange, and each flange also has a stud to limit the turning of the flange and indicate when the two flanges are in position for coupling. In the bottom of the flange recess is a packing ring of soft lead or similar material, upon which is placed a contact ring or annular seat, firmly clamped upon the

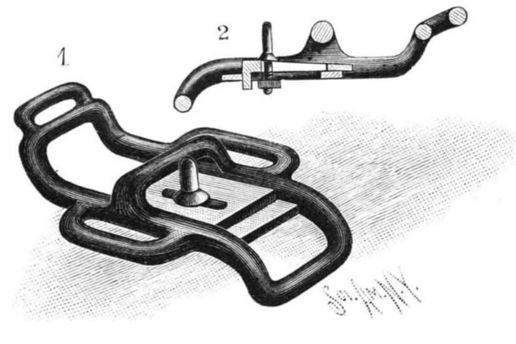


DARROW'S PIPE COUPLING.

packing ring. In arranging this coupling for use between cars, short chains attached to the cars are connected with the ends of the levers, so that when the cars pull apart, the couplings will be released by the turning of the levers by the chains.

AN IMPROVED BUCKLE.

A buckle designed more especially for use on harness, and having an adjustable wedge for clamping the strap or trace beneath a cross bar of the buckle frame, is shown in the accompanying illustration, Fig. 2 being a longitudinal section. This invention has been patented by George P. Cole, of Johnstown, N. Y. The buckle has a web extending across it from one side bar to the other, this web having a slot, and upon this web is placed a wedge also having a correspond-

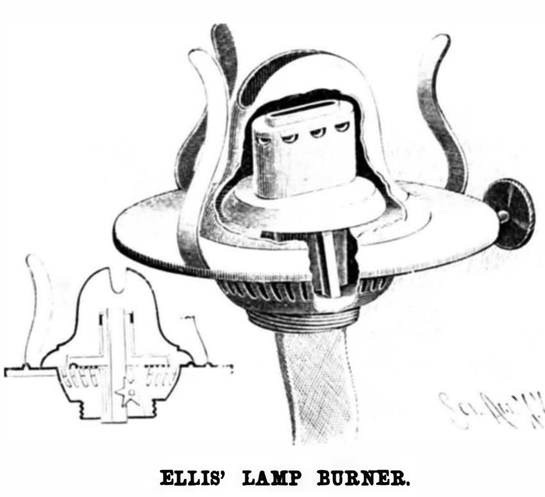


COLE'S BUCKLE.

ing slot. The shank of the buckle tongue extends through the slot of the wedge and that of the web, and is provided with a nut, the tongue being long enough to engage the elevated cross bar and having a shoulder which rests upon the outer face of the wedge. The wedge and the buckle tongue are drawn away as far as possible from the elevated cross bar in inserting a trace, and after the trace has been drawn through, the tongue is pushed back to enter the desired hole in the trace, and until the tongue comes against the cross bar; the wedge is then forced back as far as practicable, and the nut tightened to clamp both tongue and wedge in position.

AN IMPROVED LAMP BURNER.

A lamp burner designed to prevent sparks from



ELLIS' LAMP BURNER.

falling through the air tube, and prevent the tube from becoming clogged, while rendering the lamp non-explosive, is illustrated herewith, and has been patented by Mr. Stephen Ellis, of No. 1036 Grove Street, Jacksonville, Ill. Adjacent to the wick tube, on one side, is an air tube and on the other side is a gas tube, the upper end of each terminating in the perforated plate surrounding the burner, where they are covered by a detachable guard casing, which has openings in its sides near the top for the passage of air. The vertical portion of the guard casing is of such size as to form an air space surrounding the wick tube and permit air and gas to pass out. The lower portion of the burner surrounding the wick tube has side openings, permitting the outside air to enter and pass up through the perforated plate to the interior of the guard casing and out through the openings near the flame, thus causing the gas generated in the oil chamber to be drawn up through the side tubes and carried off.

Sperrylite.

A new mineral of exceptional chemical interest has been discovered, says *Nature*, by Mr. Sperry, chemist to the Canadian Copper Company, of Sudbury, Ontario, Canada. It is an arsenide of platinum, $PtAs_2$, and is the first mineral yet found containing platinum as an important constituent, other than the natural alloys with various metals of the platinum group. A considerable quantity of the mineral, which takes the form of a heavy, brilliant sand composed of minute well defined crystals, has been thoroughly investigated by Professor Wells, who names it "sperrylite," after its discoverer, and the crystals have also been measured and very completely examined by Prof. Penfield. The sand is generally found to contain fragments of chalcopyrite, pyrrhotite, and silicates, which may be removed by treatment, first with aqua regia to remove sulphides, and afterward with hydrofluoric acid to remove silicates.

After this treatment the sperrylite sand is seen to have remarkably increased in brilliancy, every grain showing extremely brilliant crystal faces, of a tin white color, resembling that of metallic platinum itself. It is very heavy, possessing at 20° a specific gravity of 10·6. Strangely enough, however, although so heavy, the sand shows a marked tendency to float upon water, owing to its not being easily wet by that liquid; even when the grains do sink, they almost invariably carry down bubbles of air along with them.

This peculiar property is retained even after boiling with caustic potash and washing with alcohol and ether, and cannot therefore be attributed to any surface impurities. Sperrylite is only slightly attacked by the strongest aqua regia, even after boiling for days, and it also remains unchanged when heated in a bulb tube to the temperature of melted glass. Heated in an open tube, however, it gives off a portion of its arsenic as a sublimate of the trioxide, the residue then fusing. When dropped upon a piece of red hot platinum foil it melts, evolving white fumes of inodorous arsenious oxide, and forming a porous excrescence in color resembling metallic platinum upon the surface of the foil.

Analyses show that sperrylite contains 52·5 per cent of platinum, mere traces of rhodium and palladium, in quantity less than 1 per cent, being also present. Prof. Penfield shows that the crystalline form is cubic, the habit being of the pyritohedral type of hemihedrism, very similar to the various members of the pyrites group, in which an atom of iron, nickel, or cobalt is united to two atoms of sulphur, arsenic, or antimony. The forms generally developed are the cube [100], octahedron [111], pyritohedron π [210], and occasionally the rhombic dodecahedron [110]. It is very curious that in the treatment with aqua regia, the cube and octahedron faces remain unattacked, while the acids exert a decided action upon the pyritohedral (pentagonal dodecahedral) faces, entirely destroying their power of reflecting light. The similarity between sperrylite and the pyrites of the iron group is rendered all the more important in view of the fact that the platinum and iron groups both occur in the same vertical row (the eighth) in Mendelejeff's periodic classification.

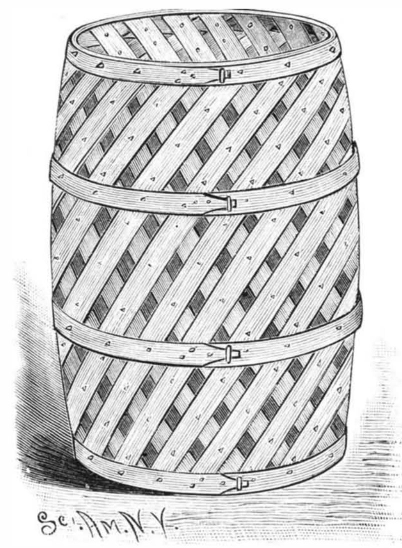
AN IMPROVED POTATO PLANTER.

The accompanying illustration represents a potato planter which forms the subject of a patent issued to Mr. John E. Ohlson, of Rockford, Washington Ter. The plow standard is provided with forwardly projecting frames, at the sides of which are located horizontal strips, held in place by bolts and nuts, so that the lower portion of the frames will be movable vertically. At the top of the standard is located a seed box, with a discharge chute extending downward to the rear of the plow. To adjust the plow for operation at different depths, pivoted links are employed, the handle lever of one of the links adjustably engaging a curved toothed bar mounted on one of the side arms, the frame and standard being mounted on the forked end piece of the pole of the machine.

A GERMAN photographer, Anshuetz, of Lissa, after some years' experiment in photographing the flight of cannon balls, has at last succeeded in obtaining photographs of the trajectory of balls moving at a velocity of 1,300 feet per second, with an exposure of only the ten-thousandth part of a second.

AN IMPROVED BARREL.

A barrel which is light, strong, and durable, and of such construction that the material carried therein will be thoroughly ventilated, is illustrated herewith, and has been patented by Mr. Isaac J. W. Adams, of



ADAMS' BARREL.

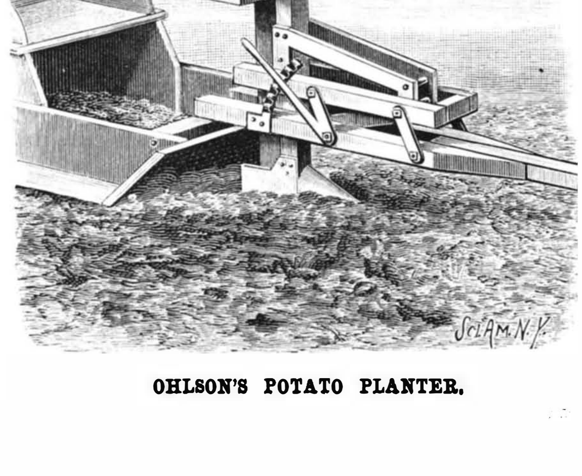
Laurel, Del. The body of the barrel is formed of two or more layers or thicknesses of splints crossing each other diagonally, the splints being nailed to each other and to the supporting hoops, as many hoops being employed as are deemed necessary or desirable. The head and bottom of the barrel may be put in in any desired manner.

AN IMPROVED MUSIC OR BOOK HOLDER.

A simple device for conveniently holding down the leaves of books in open position is illustrated herewith, and has been patented by Mr. Herbert O. Brown, of

BROWN'S MUSIC OR BOOK HOLDER.

Auckland, New Zealand. The small figure shows a side elevation of the holder, whose spring arms are adapted to embrace the edge of a shelf or other support on which the book rests, a finger being pivoted upon a rivet or screw extending into the central part of the clip. The finger has a long arm above the pivot, to bear in front of the lower part of the page of a book or sheet of music, and a short arm, with which a weight is integrally formed, to normally keep the finger in upright position. One or more of these clips may be used as desired. For further information relative to this invention address Mr. J. E. Brown, 28 Merchant Street, Honolulu, Hawaiian Islands.



OHLSON'S POTATO PLANTER.

CAPTAIN JOHN ERICSSON.

This distinguished inventor and engineer died at his home, No. 36 Beach Street, New York City, at 12:39 A.M., March 8, of an affection of the kidneys, of which he had been ailing for about two weeks, although his indisposition had not been considered serious until a day or two before his death. He would have been 86 years old on July 31 next.

Capt. Ericsson was born in 1803, in the Province of Wermland, among the iron mountains of Sweden. His father was a mining proprietor, so that in his youth he had ample opportunities to watch the operations of machinery. He early became an expert draughtsman, and exhibited a strong predilection for scientific and mechanical pursuits, making several philosophical instruments and miniature machines before he was eleven years of age. Count Platen, a distinguished civil engineer, and friend of Bernadotte, King of Sweden, heard of Ericsson's precocious mechanical talents, and went to see him. The Count examined his plans and drawings, and expressed high approval of them, saying: "Continue as you have commenced, and you will one day produce something extraordinary"—words of encouragement which sank deeply into the mind of the young mechanic.

Young Ericsson was soon afterward entered as a cadet in the corps of Swedish engineers, and at 12 years of age was appointed to service under Count Platen, in the construction of the series of canals which, in connection with river and lake navigation, gives Sweden internal communication between the North Sea and the Baltic. The work was carried on by the labor of soldiers, and young Ericsson had to provide employment for about 600 men. Work was conducted only in the summer, but his time in winter was devoted to the plans and drawings, and many important works on the canal were constructed after the drawings made by him at this early age.

He afterward entered the Swedish army as a lieutenant, at the age of 17, rose to be captain, and was appointed military surveyor of the north highlands of Sweden, the archives of the government at Stockholm now containing maps executed by his own hand of fifty square miles of territory.

He was also at this time actively occupied with mechanical inventions, and made a small engine to be operated by the heat products of Swedish pinewood as a substitute for steam—this engine probably being in fact the real predecessor of the hot air engine, which he afterward successfully developed. In order to better prosecute his plans in connection with his new motor, he visited England in May, 1826, and took up his abode in London. Here he soon brought out a number of other new inventions, especially an improved boiler with artificial draught, associating himself for its manufacture with Mr. John Braithwaite. While

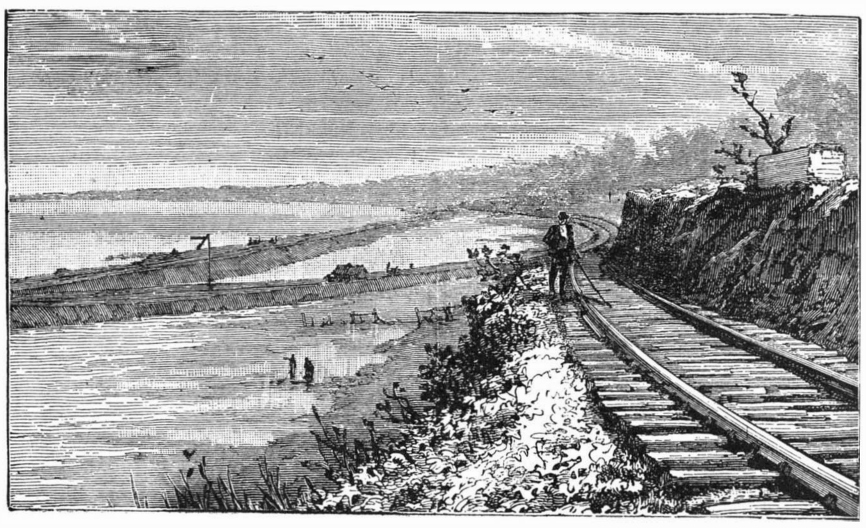
CAPTAIN JOHN ERICSSON.*

thus engaged, in 1829, the Liverpool and Manchester Railway Company offered a prize for the best locomotive engine. Ericsson immediately set to work and planned an engine, made the working drawings, had the patterns made, and the whole machine completed within seven weeks. Three engines were entered for the prize—the Rocket, built by George Stephenson, the Novelty, by Ericsson, and the Sanspareil, by Timothy Hackworth. The details of this competition have afforded one of the most interesting chapters in the whole history of steam engineering. The Novelty had a bellows draught and winding flue boiler, and with its tank weighed 3 tons 17 cwt., while the Rocket weighed with tank 7 tons 9 cwt. The Rocket was the only engine which fulfilled the conditions required, and therefore was the accepted competitor, but the Novelty commanded high praise, and is said to have made a speed as high as fifty miles per hour.

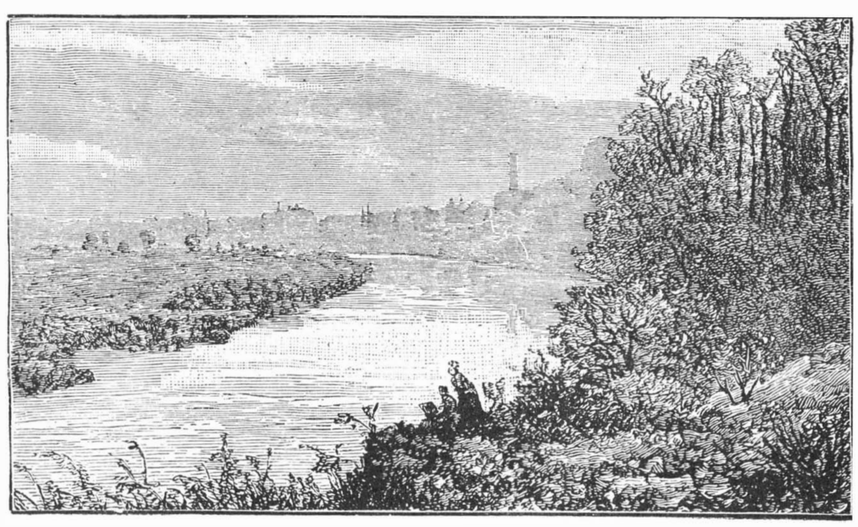
Captain Ericsson about this time brought forward the idea of a screw propeller for vessels (which had been before proposed) and urged its adoption, especially for war vessels, in conjunction with the arrangement of screw and all the machinery under the water line. He proved the utility of his plan on a small boat on the Thames, which the watermen styled the Flying Devil. The British Admiralty authorities took a trip on this boat, but decided against the plan from the supposed difficulty of steering a war vessel with a screw at the stern. Two Americans had, however, examined Captain Ericsson's drawings, taken a trip on his little vessel, and highly appreciated its merits. They were Francis B. Ogden, American consul at Liverpool, and Commodore Robert F. Stockton, U. S. N. Through the influence of the latter, Captain Ericsson came to the United States in 1839, and in 1841 became engaged with Commodore Stockton in building the U. S. steam frigate Princeton, said to be the first successful propeller war vessel with all its machinery under the water line. In France Captain Ericsson is called the father of screw propulsion applied to war vessels, as he designed the Pomone, the first screw vessel in the French navy. In 1837 he built a vessel having twin screw propellers.

About 1833, Captain Ericsson brought out his first practical hot air engine, which has undergone many improvements since that time, but of which many thousands have been in use for years, although, when considerable power is required, the high anticipations at first entertained in regard to them have not been realized. He was also among the earliest constructors of steam fire engines, an engine of this kind made by him having been used in London in 1829. During the thirteen years that Captain Ericsson lived in England he is said to have brought out forty new inventions. Among them were a file-cutting device; an instrument, still in use, for taking soundings at sea; a

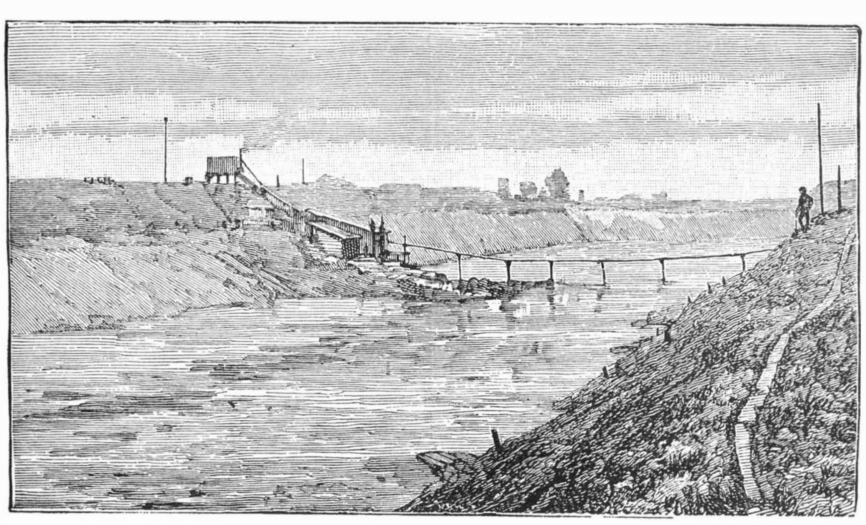
* A more extended illustrated article upon Capt. Ericsson and his work will be published in the next issue.



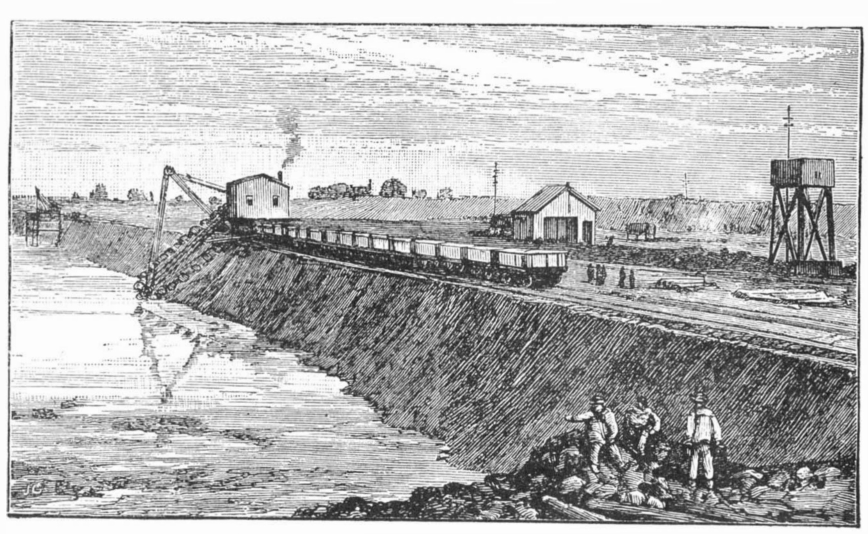
THE MERSEY ESTUARY WORKS NEAR EASTHAM.



SITE OF THE WARRINGTON DOCKS.



DIVERSION OF THE MERSEY AT THELWALL.



THE GERMAN STEAM DIGGER AT LYMM, CHESHIRE.

PROGRESS OF THE MANCHESTER SHIP CANAL.—[For description see page 164.]

hydrostatic weighing machine, an apparatus for making salt from brine, a pumping engine, a rotary steam engine, and a system of artificial draught for steam boilers, dispensing with huge smokestacks and economizing fuel. In 1828 he applied on the Victory the principle of condensing steam and returning the water to the boiler, and in 1832 he gave to the Corsair the centrifugal fan blowers now generally used in American steam vessels. In 1830 he introduced the link motion for reversing steam engines on the locomotives King William and Adelaide, and in 1834 he superheated steam in an engine on the Regent's Canal Basin.

Undoubtedly the greatest of all Capt. Ericsson's achievements, however, and the one by which his name has become most widely known, was the building of the Monitor, in 1861. This little iron gunboat, almost submerged, and with revolving turrets for the guns, was so successful in the now historic naval engagement at Hampton Roads, early in 1862, that the combat marked an epoch in modern warfare on the sea, and changed the course of naval construction throughout the world. This vessel was built by Capt. Ericsson in one hundred days from the time the contract therefor was signed, and at a cost of $275,000. Little faith was anywhere felt in her success, and it was only with great difficulty that the government was induced to enter into the contract; but immediately following the day on which the Monitor drove the Merrimac, disabled, back to Norfolk, all maritime nations began the policy of building armored ships, which, with many changes, has since been pursued.

Capt. Ericsson has since made many improvements in this class of vessels, and in 1878 had constructed, at the Delamater Iron Works, a torpedo boat, which he styled the Destroyer, that had many novel and ingenious features. During the attack the vessel is to be submerged, the torpedoes themselves to be discharged under water by the aid of a novel construction specially designed therefor.

During late years Capt. Ericsson has devoted a good deal of time to the construction of a sun motor, and has built a series of experimental machines for utilizing the sun's radiant heat. The leading feature of these machines is that of concentrating the heat by means of a rectangular trough, having a curved bottom, lined on the inside with polished plates, so arranged that they reflect the sun's rays toward a cylindrical heater placed longitudinally above the trough, this heater to contain steam or air, to transfer the solar energy to the motor.

Captain Ericsson has resided for more than a generation at the house where he died, but for many years it has been rare that any one has been allowed to see him. He had a high appreciation of the value of time, economizing every moment in the working out of some one or another of many proposed improvements. The speed with which he mastered details and threw off designs is said to have been almost unparalleled, and he was a very close critic of all plans or drawings made for him. His manners were simple and dignified, but without assumption, and he impressed every one with whom he came in contact by his broad views and rich stores of learning.

The deceased leaves no family. He married an Englishwoman many years ago, but his wife died childless more than a quarter of a century ago.

THE MANCHESTER SHIP CANAL.

Although little more than a year has elapsed since the cutting of the first sod in this vast undertaking, the work is now, thanks to the energy of the contractor, Mr. T. A. Walker, in a remarkably forward state. Indeed, more than one-third of the actual excavation has already been accomplished. The transformation wrought along the line of the canal in so short a time is truly marvelous. The meadows along the banks of the Mersey and Irwell, on the borders of Lancashire and Cheshire, now resound with the shrieks of dozens of busy little locomotives and the rattle of innumerable pumps and steam excavators. The landscape has suffered rather badly; not only has every tree along the canal been felled, but entire woods, such as those at Moore and Eastham, have been wiped off the face of the earth; while the green meadows have been cumbered by enormous and hideous spoil-banks, which meet the eye in every direction. The end, however, in this case, at least, certainly justifies the means. A few years more, and the locomotives and other machines will, doubtless, be at work on one or other of the many ship canals now being projected; while the earth will hide its scars, and the unsightly tips will be clothed with a green mantle of herbage.

The greater part of the excavation is performed by various kinds of machines, of which the German digger is, perhaps, the simplest in its action, and, in suitable soil, the most effective. It is in reality a land dredger, and will excavate loose sand or soft earth at the rate of about two thousand tons per day, but in hard or stony ground it is helpless. The American digger, on the contrary, will cut through the hardest soil, and even soft sandstone, with the greatest ease; nay, it will even tackle the hard sandstone rock, after this has been "shaken up" with dynamite or blasting powder. There is something apparently diabolical in its method of working. With every movement of its huge spade it rips up a ton and a half of earth; and no one who has watched its work will deny that its nickname, "Yankee Devil," if not euphonious, is at least appropriate. Though of American parentage, this digger is made at Lincoln. Its daily task amounts to some one thousand two hundred tons. Besides these two machines, there are two other forms of powerful excavators, and many of other patterns working on the canal. The total number of machines employed is over eighty, while more than a hundred locomotives are required to dispose of the spoil. Some idea of the undertaking may be formed from the fact that Mr. Walker has found it necessary to lay upward of two hundred miles of temporary railway.

After leaving the Manchester, or No. 3, dock, the canal immediately passes the great No. 1, or Salford dock, where already the concrete quay walls are being built. From this point to Thelwall the canal follows pretty closely the course of the twin rivers Mersey and Irwell, touching little of importance save the Bridgewater Viaduct at Barton, to which we have already referred, and two railways—namely, the Cheshire Lines Railway at Irlam and the Midland line at Partington. These two railways, as also the other three which are cut by the canal, will be diverted and considerably elevated, crossing the canal by high level bridges, so as to leave a clear headway of seventy-five feet. At Thelwall the canal leaves the course of the Mersey and cuts straight across country to Runcorn, demolishing many private houses and the Latchford railway station on its way. It just touches the river below Warrington, at the site of the Warrington docks, which will be formed along the old river course. At Runcorn the canal again joins the Mersey. For the greater part of this distance the ship canal runs along the line of the old Mersey and Irwell Canal, which has already been blocked for traffic in a very summary manner. From Runcorn the canal skirts round the Cheshire side of the estuary of the Mersey as far as Eastham, where it finally enters the river. It thus crosses the mouth of the Weaver, and taps the salt traffic from Norwich and the Cheshire salt field.

Our illustration shows how the canal crosses one of the bays of the estuary, the canal being separated from the river by a training wall, which is being tipped across the bay from shore to shore.

The "Track-bridge," at Lymm, carries the contractors' main line across the Mersey. There are five such bridges within two miles, to such an extent does the river wind about. This railway now extends, without a break, the whole of the distance between Manchester and Eastham, and is the line shown in our view of the estuary works.

The canal, when finished, will be one hundred and twenty feet wide at the bottom, and the sides will be faced with stone. The whole of this stone is being cut out of the canal at Eastham, Ellesmere, Moore, Barton, and other places; while all the bricks required for the locks, railway works, and different structures are being made at Lymm. An excellent clay is dug out of the cutting there, and is converted into bricks by machinery on the spot. There are two mills at work, and the total output is about a quarter of a million bricks every week.

The river diversion at Thelwall is being cut to straighten the course of the Mersey a little; otherwise the canal would cut it twice within about three hundred yards. The deviation is now being faced with stone.

We are indebted for our present illustrations to some photographs taken by Mr. H. C. Bayley, of Lymm, near Warrington.—*Illustrated London News.*

The Robert Process for Iron and Steel.

About a year ago, a Frenchman, Gustave L. Robert, of Stenay, France, made some experiments which were the starting point of the new process, and the news of his experiments came to the ears of J. W. Bookwalter, the manufacturer at Springfield, Ohio. When he heard of this discovery, Mr. Bookwalter immediately went to see Robert's experiments, and he secured the right to the process in the United States. Returning to his factory in Springfield, he built an experimental plant and improved and expanded upon the idea of the inventor. After twelve months of experimenting he has perfected the invention, and within a month or two his first patent has been issued.

The process is so simple that every iron worker will wonder that he did not discover it long ago. It can be best explained by comparing it with the Bessemer process. The peculiarity and the defect of the Bessemer process is that the air is blown perpendicularly through the mass of iron, keeping it in constant agitation, and therefore mixing all the impurities with the iron. If the current of air be blown long enough to burn out all the silicon and carbon, the oxygen will also attack the iron, and the resulting product will be a weak and oxidized iron. To remedy this, the Bessemer system introduces some ore of iron, such as ferro-manganese, containing a large amount of carbon, and a certain amount of this peculiar ore is necessary to be used with the common ore to produce the Bessemer product. The Bessemer converter blows the air from below the mass of iron.

In the new converter, on the other hand, the blast is over the edge of the iron, horizontally, and produces a rotary motion in the metal, causing a most violent agitation, which presents every portion of the metal to the blast and at the same time blows the slag and other impurities which are floating on the surface to the farther side of the converter.

It will be seen that this converter is simply a mechanical means of doing exactly what the puddler does by hand, turning the iron over and over, and presenting all parts of the molten mass to the air, and exposing only a small portion of it at a time to the action of the blast. So long as there is any silicon in that part of the metal exposed to the blast, the oxygen will attack neither the iron nor the carbon; and so long as there is carbon, the oxygen will not attack the iron. By the new process all the silicon, and practically all the carbon, can be burned out of the iron, or only the silicon may be burned out and the carbon left, and the impurities removed by gathering them on the surface of the molten metal, leaving steel when the blast is stopped.

Thus, by the new process, every grade of iron can be made, from the purest wrought iron to the highly carbonated steel. It covers the whole catalogue of products of iron ore. The new process is like the Bessemer process in this—no fuel is necessary in converting the melted cast iron into the finished product, which by the Bessemer process is Bessemer steel, and by the new process is any grade of iron or steel that may be desired, whether metal for machine bolts or metal to be made into surgeons' tools. The development of the Bessemer process has prepared the way for this new process. The perfection of the converter, and of the blast machinery, and all those appliances which distinguish the Bessemer works of to-day from the early ones, are necessary in the new process. The marvelous feat of mechanical engineering which was hardly a less noteworthy achievement of Sir Henry Bessemer than the discovery of his process itself is as useful to the new process as to his. A Bessemer converter weighs, with its contents, from twenty to thirty tons, and it is moved by a gentle effort, and it receives a blast so powerful that the whole mass of molten metal is heated to the highest temperature that has hitherto been used in the practical mechanical arts. In the materials of its manufacture, and in the appliances for its manipulation, the new converter has the same essential necessities as the old.

Since the metal which comes from the Robert converter can be a pure iron, a low or mild steel, or a steel high in carbon, from this converter can be poured every grade of metal that is used by the smith or a rolling mill. And this range of metal includes iron that is now made by the puddling process, which is the iron used by the smith and manufactured by the rolling mill into all forms of bar and sheet iron; the steel now made by the Bessemer converter, which is used for railroad iron, for iron beams and girders for buildings, for ship building, and all forms of massive iron; the mild steel which is used for boilers and those processes requiring a soft and tough steel; and a crucible steel, from which are made the tools and all the finer products of the mechanic. This means that every grade of iron or steel that has hitherto been used for railroad bars and ship plates can now be produced by the same method; and that all products of the ore may be produced by a mechanical process, and so cheaply as to give a greater stimulus to the use of iron and steel than any previous invention. Since the blast of air in the Robert process does not support the enormous mass of iron as in the Bessemer process, the blast is vastly less, and the entire plant, including engines and all the necessary machinery for the production of 100 tons a day of any grade of iron or steel, can be built for less than $10,000, or one-third the cost of the Bessemer plant of the same capacity. The tuyeres of a Bessemer converter must be renewed after fifteen blasts. The tuyeres of the new last for 250 blasts. The Bessemer converter must be relined after a very few blasts; the Robert after 1,000 blasts. By the new process the metal is heated much hotter than by the Bessemer process, and is therefore much more fluid; but this quality, added to the freedom from impurities, enables the new converter to pour the metal directly into the billet which is to be rolled into the desired form, whereas the Bessemer product is so impure that it is cast first into a 14 inch ingot, and then "broken down," as it is called, being rolled through a succession of rolls which reduce the ingot to four inches square. The new system makes possible the saving of about four dollars a ton in the making of the billet.

The cost of making all grades of iron or steel is the same by the Robert system, and that cost is less than the cost of making Bessemer steel. The significance of this will be appreciated when it is realized that the poorest grade of iron costs from four to six dollars a ton more than Bessemer steel, and the highest grade of tool steel costs several hundred dollars a ton more. Not only are all these products, which are already made by other methods, produced cheaper and more rapidly by the new process, but a class of products can be made which it has hitherto been impossible to make. From the converter the metal can be poured into moulds, and castings can be made which have all the properties of wrought iron. They can be bent, hammered, welded, and in all respects treated as if they were the product of the forge and not of the foundry. This means a revolution in the building of machinery. Wrought iron is five to seven times as strong as the best cast iron. If, therefore, any piece of machinery requiring strength be cast of metal purified by the new converter, it can be one-fifth the present weight and of equal strength; or, if made of the present weight, of more than five times the present strength. There have been numerous attempts to increase the strength of castings, and to make what are known as malleable castings. The most successful has been the process of annealing. But this process has thus far failed in producing, for instance, heavy ordnance. If a highly carbonized metal from the new converter be cast, and the castings be permitted to cool slowly, it will be a soft steel, and part of which can then be tempered to any degree of hardness desired. The advantages of this are very great in the manufacture of such products as car wheels and heavy ordnance.

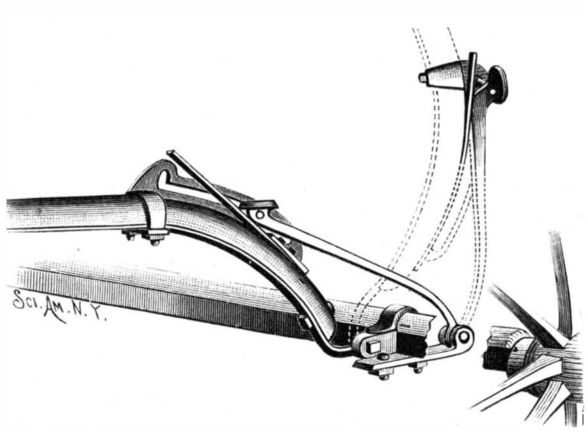
The present manufacturers of steel and iron can utilize nearly all their present plants—all except the puddling furnace—when they adopt the new system. The greater part of most of the existing manufacturing plants is as necessary for the new process as for the old ones; and the additional machinery required is not costly in comparison with the cost of Bessemer converters.—*Harper's Weekly*.

Learn a Trade.

The practical advantage to one who has learned a trade was exemplified the other day in the person of Patrick Gleason, Mayor of Long Island City. The appropriation for the maintenance of the water department having run short, a number of the men have been unpaid for some time. The other day they simply said that, if they didn't get their money, they would shut down the waterworks. Mayor Gleason, who has attained fame of late by his manful attack upon the fences and other obstructions of the Long Island Railroad, which he leveled single-handed with an ax, said that he didn't propose that Long Island City should be left without its water supply. He couldn't force the city officials to appropriate the money, but he hitched up his trotters, drove to the waterworks, and told the men on duty that if they wanted to leave they could leave, he could run the engine himself, with the assistance of one or two of his friends. As he is an old engineer, says *Fire and Water*, they all knew he could do what he said. Consequently, there was no strike, Long Island City was not deprived of its water supply, and since then, we understand, the salaries have been paid up. This is the kind of a mayor to have.

AN IMPROVED VEHICLE SHAFT SUPPORT.

The accompanying illustration represents a simple attachment whereby the shafts or pole of a vehicle may be supported in elevated position when the vehicle is not in use, the shafts being shown thus supported in dotted lines. This invention has been patented by Mr. James A. Peel, of Springport, Ky. An arm is pivotally connected with the forward axle of the vehicle, the outer end of the arm having a stud passing through a slot in a plate attached to the shaft, the forward end of this slot having a recess extending at right angles to the slot. To the plate attached to the shaft is riveted a spring bearing against the under side



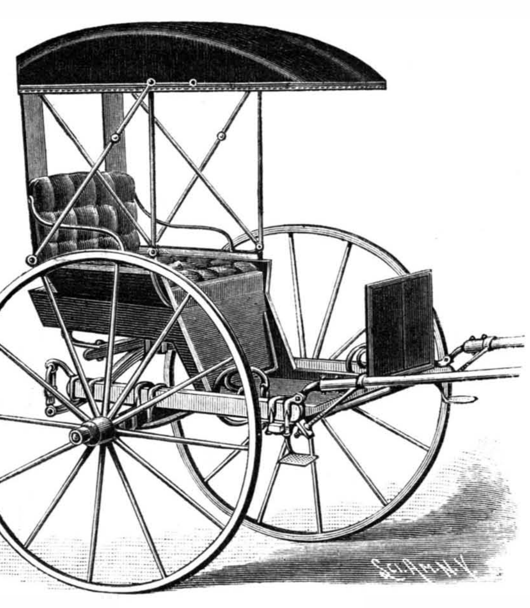
PEEL'S VEHICLE SHAFT SUPPORT.

of the forward end of the arm, and acting to throw the stud into the recess when the shaft is moved to the position indicated by the dotted lines. The shafts can then only be lowered by throwing the arm down against the tension of the spring, bringing the stud where it will slide in the slot of the plate attached to the shaft.

VALUABLE SEEDS.—Seeds of the most valuable varieties of cinchona bring $1,000 per ounce in Ceylon. There are nearly 100,000 seeds in an ounce.

AN IMPROVED ROAD CART.

A vehicle designed to secure absolute freedom from horse motion, and in which the thills or pole may be adjusted to suit horses of different heights, is shown herewith, and has been patented by Dr. Lewis J. Lyman, of Manhattan, Kansas. To the rear ends of the side bars a rear spring is attached by flexible connections, such as heavy straps, which permit the spring to swing freely, the body being secured to the spring by a cross bar and irons. The front springs are circular, and are attached to the side bars by suitable inwardly projecting arms, the front of the body resting on a cross bar connected with the outer ends of the springs by flexible connections, so that the body is suspended



LYMAN'S ROAD CART.

and free to swing freely in all directions. The thills are coupled to the front ends of the side bars, and are held in elevated position by brace rods which pass through eye plates attached to the under surface of the side bars, the braces being screw-threaded and provided with nuts for raising and lowering the thills.

Self-acting Car Couplers Must be Employed.

At the recent session in Washington of the State Railway Commissioners with the Interstate Commerce Commission, Ex-Commissioner Coffin, of Iowa, now representing the Brotherhood of Brakemen, made an address which was received with marked attention. In the course of it he said, referring to the slaughter of men by the old link and link coupler and the hand brake: "Our commission in Iowa has caused a law to be made that has been on the statute books ten years, to the effect that the railroads shall report to the commissioner the accidents occurring along their lines, and it is shown that in ten years we have killed and maimed 2,424 men in the State of Iowa by these two causes alone.

"These are astounding facts. The average would be something like 240 a year. These reports commenced when we only had 5,000 miles of railway, while now we have 8,000. The commissioners' report last year shows that there were killed and wounded by these two causes alone 349. We think in Iowa our roads are managed as carefully as any roads. We are a temperance State, and our railway men are temperate and careful, and still last year there were over 349 men killed and maimed by the two causes I have spoken of.

"There are 150,000 miles of railroad in the United States, and over six thousand of their active, strong men were either killed or maimed for life from those two causes alone last year. I state these facts so as to inspire a sort of enthusiasm on the part of the Interstate Commerce Commissioners to induce them to use their influence to pass an act by the national legislature compelling the adoption of safety appliances. I have a table in my hand, in condensed form, showing that in all the great accidents in the last fifty years there were less killed and maimed than there were killed and maimed by the two causes I have spoken of last year. These facts are astounding.

"The resolution which you have passed looks toward national legislation in regard to these safety appliances. The only legislation needed, in my judgment—take it for what it is worth—is that in regard to couplers and brakes. The matter of heating cars will take care of itself. As a matter of advertisement, every main line will have these safety heating apparatus, but you and I will send our car load of hogs, or steers, or whatever it may be, on any train on any road that will take them, no matter if a half dozen brakemen are killed at a time in coupling the car in which our freight is to another car in a train that is to carry the load on.

"Let me give you another fact. Last year, in the State of Iowa, there were 29,435,846 passengers who traveled. Not one was burned by a fire heating stove. While at the same time we killed and injured in that State by the pin and link coupler 350."

A Lake of Petroleum.

The New York *Tribune* states that E. C. Beardsley, a well known oil and gas expert, of Pittsburg, was recently delegated by Booth & Flynn, R. C. Elliott, and other capitalists to visit Utah with a view to ascertaining what truth there was in the report that great fields of asphaltum containing hundreds of thousands of tons were to be found in that region. Mr. Beardsley has just returned, and in speaking of his visit said:

"Seven hundred thousand tons of asphalt seems like a large amount, yet a field near Vernial, Utah, contains fully that quantity. It was located and partially owned by Thomas Walley, a native of Armstrong County, Pa. This asphalt was formerly crude petroleum which escaped from natural openings in the ground, flowed into the plains, where it now lies, and there dried. The field is located some little distance from a railroad, but a line is being rapidly built—the Colorado and Midland—which will tap it. Asphalt is worth $20 a ton. Ex-Senator Tabor, of Colorado, is interested in the company about to develop the field, and the capital is $1,000,000.

"In Wyoming, near Fort Washita, is another big asphalt field. Timothy Mullin, of Pittsburg, is interested in the oil-producing fields of this district. There is actually a petroleum lake in that region. I was there and saw it. Mullin and George Graff, two Pennsylvanians, discovered a number of oil springs on Poison Spider Creek. They turned the course of the stream and formed a large natural oil tank out of what had once been the bed of Poison Spider Creek. They then turned the oil into this basin, and as it has been flowing at a fair rate for many months, a lake of petroleum has been formed. They have thousands of barrels of the fluid waiting for the railroad to come and haul it to the ocean. The long-expected railroad may reach that locality this summer."

Speed Trials of American Steam Yachts and Naphtha Launches.

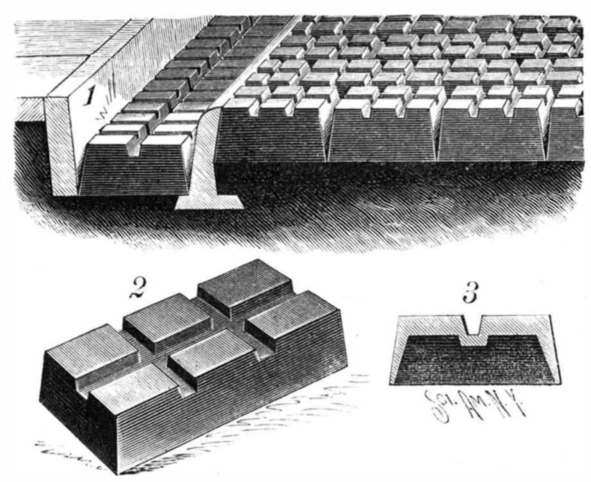
The ability of American steam yachts to maintain a high speed over a course of eighty nautical miles, with one turn, has again been tested in the races of the American Yacht Club during the past season. It seems that the required speed of sixteen nautical miles (18·44 miles), to win the Atalanta's challenge cup, was not reached by the contestants.

The fastest time made over the 80 knot course for the past four years is, for 1884, 4h. 42m. 57s.; 1885, 4h. 53m. 50s.; 1886, 4h. 34m. 57s.; 1888, 5h. 3m. 50s., which shows that the speed of the past season was considerably less than in former years.

The naphtha launch races also afford some interesting features in regard to the size and speed of this class of launches, the past season being the second of these races, over a course of 8 knots (9·22 miles), the fastest time over the course being 68·082 minutes, or at the rate of 8 miles per hour.

AN IMPROVED PAVEMENT.

A pavement designed to be strong and durable, and which may be readily taken up and replaced, has been patented by Mr. Johann E. Knoche, of San Jose, Cal., and is illustrated herewith. This pavement consists mainly of hollow metal blocks or shells, as shown in perspective and section in Figs. 2 and 3, these blocks to be either left empty or be filled with concrete or other material, and checkered on their upper surfaces. Substantially similar blocks are used both for the carriageway and the gutter, but a flanged sup-



KNOCHE'S PAVEMENT.

port, as shown in Fig. 1, forms the edge of the gutter, the flanges bearing against the sides of the carriageway blocks and bracing them and the gutter blocks. In laying such a pavement the blocks are arranged to break joints.

THE weight of the great smoke cloud daily hanging over the city of London, England, has been computed by Prof. Roberts at 50 tons of solid carbon and 250 tons of hydrocarbon and carbonic oxide gases for each day of the year, and its value at $10,000,000 per annum.

THE CHARITY INSTITUTIONS OF PARIS.

In recent years, in France, conscientious efforts have been made to ascertain the principal causes of the loss of population, and it has been demonstrated by numerous facts that one of these causes consists in the physical degeneration induced by deficiency of alimentation in infancy; and the most eminent physicians of Paris, and the Director of Public Assistance, have endeavored to modify and improve the system of nutrition in the public charitable institutions, providing for recently born children lactation adequate to the necessities of the temperament and constitution.

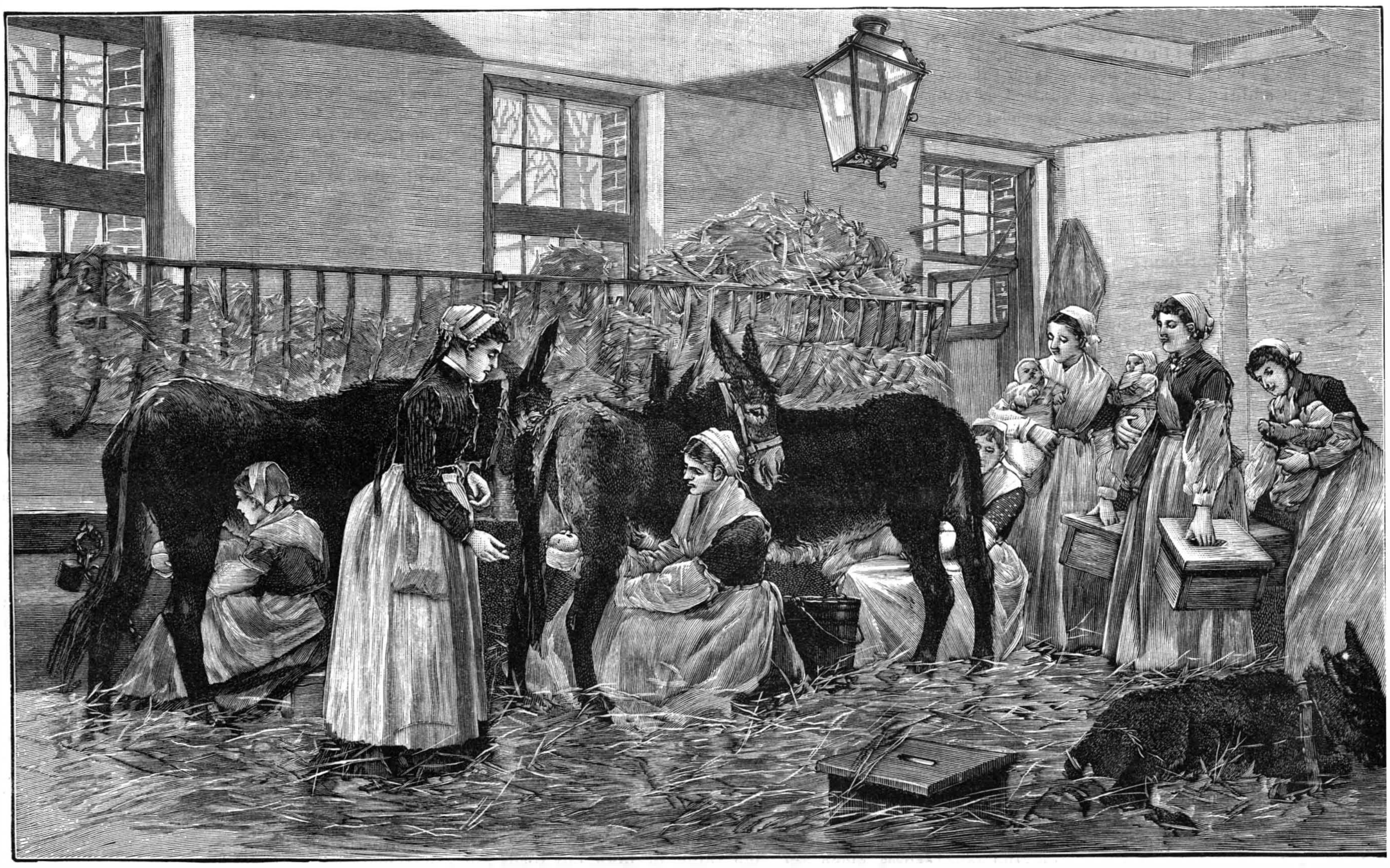
In the Hospital for Infants' Diseases, situated in Sabres Street, there exists a section for rickety boys and girls, whose miserable aspect produces an impression of pain upon the mind—unfortunate beings who have inherited the organic vices of their parents, and who suffer from anæmia's cruel tortures.

The administration of the hospital is arranged in two separated pavilions, where there is much ventilation, with large windows that look out upon a garden, and whose walls have double rows of willow cradles perfectly equipped. The newly born receive here the personal care of the establishment, beginning with being weighed in the balance the same day they make their appearance, the operation being frequently repeated almost every month in order to determine with exactness the development of the child. The little one is subjected to an especially nutritious diet of the most tonic kind, if it had been previously fed from a refractory goat liable to convey contagious germs, it having been found by experiment that the milk of this animal, although possessing nutritive principles of the most salutary kind, presents the inconvenience of communicating by absorption the effects of those nervous accidents to which the goat is subject.

The public charities of Paris, advised by the wise doctors of medicine, have substituted for the milk of goats that of the ass, and have installed an ample yard near the pavilion of the rickety and scrofulous children, which is only separated by a short covered passageway. Nothing is more picturesque than the spectacle of the lactation of the babes in this inclosure every morning, as graphically represented in our engraving, from a drawing by M. De Haenen.

The nurses, dressed in dark gowns with white caps and aprons, each carrying a child on the right arm and a little seat in the left hand, present themselves in exact turn to the women who have charge of the animals, and they hold the child, applying its lips to the teats of the docile animal. The children suck with avidity the liquid nutriment, which is fresh and of agreeable taste.

The Administration of Public Assistance of Paris has calculated that one young ass is able to lactate abundantly for a space of nine or ten months, and when this period has passed they are sold and replaced by others. It is well known that the milk of asses, by its vivifying qualities and its nutritious principles, assimilates in a great degree the milk of the nurse, and these disinherited and sick children, enjoying its beneficial effects by its permanent and methodical use, are restored little by little to health and vigor.—*La Ilustracion Espanola.*



THE CHARITY INSTITUTIONS OF PARIS—NURSING INFANTS WITH ASSES' MILK.

American Steamships.

Iron ship builders on the Delaware are at present well off for orders for large ocean steamers. The Pacific Mail Steamship Company is in the market for two iron steamers of about 5,000 tons each, to cost 400,000*l.*, for the San Francisco and Central American trade. The Ward Steamship Line, to Cuban ports, has contracted with the Delaware River Ship Building Works for two iron steamships, 310 feet long, to register 3,000 tons each. Contracts have also been made for two iron steamships for the Ocean Steamship Line, to ply between New York, Philadelphia, and Savannah. Mr. C. Mallory has contracted with the Delaware River Ship Building Company for a 3,000 ton coasting steamer, to cost $350,000, for the Galveston Line. The Morgan Steamship Line, plying between New York and New Orleans, and the Pacific Improvement Company, of California, running to the North Pacific ports, and the Oregon Railway Company are also in the market for two steamers each. Colonel E. Hogg, of the Oregon Pacific Railroad Company, also needs two iron steamships to trade between San Francisco and Yaquina Bay, Oregon.

[NATURE.]

The Employment of the Sucker Fish (Echeneis) in Turtle Fishing.

The only two references to the employment of the sucker fish in turtle fishing which I have by me are those in Dr. Gunther's "Introduction to the Study of Fishes," and the "Narrative of the Voyage of H. M. S. Rattlesnake," by J. Macgillivray. The latter (vol. ii., p. 21) states that he was informed that the natives of Morulug (Prince of Wales Island), Torres Straits, catch a small species of turtle in the following manner:

"A live sucker fish (*Echeneis remora*), having previously been secured by a line passed round the tail, is thrown into the water in certain places known to be suitable for the purpose. The fish while swimming about makes fast by its sucker to any turtle of this small kind which it may chance to encounter, and both are hauled in together!" Dr. Gunther (*l. c.*, p. 461) throws doubt upon the habitual utilization of the *Echeneis* for this purpose.

In the Straits there are two periods for turtle fishing, the one during October and November, which is the pairing season, and when turtle are easily speared, owing to their floating on the surface of the water, the other during the remaining months of the year, when the turtle frequent the deeper water and the channels between the reefs. It is then that the sucker fish—or, as the natives term it, "gapu"—is utilized. I have, at present, no means of determining the species of *Echeneis* common in the Straits. I believe it to be *E. naucrata*, as the species here attains a greater length than *E. remora.*

When going out turtle fishing, a gapu is caught, and the more experienced natives have no great difficulty in procuring one when it is required. A hole is made at the base of the caudal fin by means of a turtle bone, and the end of a very long piece of string is inserted in the hole and made fast. The end of a second, quite short, piece of string is passed through the mouth and out by the gills. By means of these two strings the fish is retained, while slung over the sides of the canoe, in the water. When a turtle is sighted deep down in the water, the front piece of string is withdrawn, plenty of slack being allowed for the hind string.

The gapu, on perceiving the turtle, immediately swims toward it, and attaches itself to the reptile's carapace. A man, with a long rope attached to an upper arm, dives into the water and is guided to the turtle by the line fastened to the gapu's tail. On reaching the turtle, the man gets on its back, and passes his arms behind and below the fore flappers, and his legs in front and below the hind flappers. The man is then rapidly drawn up to the surface of the water, bearing the turtle with him. On the arrival of the diver the gapu usually shifts its position from the carapace to the plastron of the turtle. At the end of the day's fishing the gapu is eaten. The natives have a great respect for the gapu, and firmly believe the fish possesses supernatural powers. For example, when there is something the matter with the bow of the canoe, the gapu is said to attach itself to the neck or the nuchal plate of the turtle; when the lashings of the outrigger to the thwart poles are insecure, the gapu is believed not to stick fast to the turtle, but to continually shift its position; if the strengthening ties in the center of the hold of the canoe are faulty, the gapu is stated to attach itself to the turtle and then immediately to swim away. More than once I was told, "Gapu savvy all the same as man. I think him half devil." The sucker fish is not used to haul in the large green turtle. I was repeatedly told that it would be pulled off, as the turtle was too heavy. The above information was gathered from several sources, and checked by means of much questioning.

Ergosterine.

The substance in question is named ergosterine, and has the composition $C_{52}H_{40}O_2$. It is slowly oxidized on exposure to the air, becoming colored and odoriferous. It is not attacked by strong boiling alkaline solutions. Like cholesterine it is a monoatomic alcohol. With nitric acid or hydrochloric acid and ferric chloride it gives the same reactions as cholesterine. But it dissolves completely in sulphuric acid, and chloroform, if shaken up with the mixture, remains colorless.—*C. Tanret.*

A SUGGESTION IN CANAL BOAT PROPULSION.

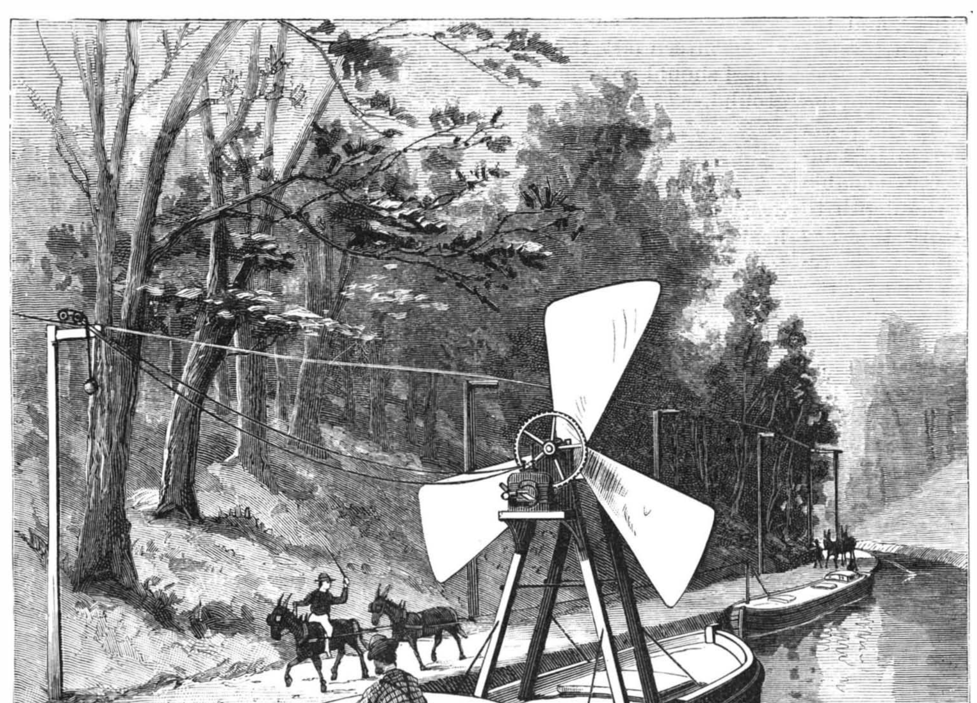
A paper which excited much attention was read at the last meeting of the British Association for the Advancement of Science, by H. C. Vogt. It is published in full in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 670. It was devoted to the subject of the propulsion of ships by air propellers. In it Mr. Vogt gave the summary and results of some very remarkable trials in navigation, executed at Copenhagen. A steam launch was fitted with a windmill with steel blades. It was carried on a frame above the deck, and formed an aerial propeller wheel. Steam machinery was provided for rotating this. With this as a propeller, it was proposed to drive the boat. At first sight the method would seem an extremely inefficient one as regards application of power to so unstable a medium as air. But when it is remembered that recent investigations of the marine propeller have established it as a true reaction engine, in which a large slip is not necessarily an accompaniment of inefficiency, it will appear clear that there is nothing wrong in the principle indicated by Mr. Vogt. An air propeller is a pure momentum or reaction machine. Practically, it was found that a twenty foot launch of five and one-half feet beam, with a propeller eight and one-half feet in diameter, could be driven at a speed of five knots per hour in calm weather and against a fresh breeze at four knots. The engine producing this effect indicated one and one-half horse power. For a single indicated horse power the thrust of the propeller was 36·7 pounds or about the same as that of a water propeller. It might be supposed that in a contrary wind this thrust would disappear, but, on the contrary, through seventy-five per cent of the horizon the thrust was found to be augmented by the wind.

With a larger launch, having a displacement of five tons, a speed of over six knots an hour was obtained against the wind. In some of the trials canvas-covered wings were used, but were found inferior to the steel ones.

We illustrate in the cut accompanying this article a suggestion in the direction of canal boat propulsion. A barge is provided with one of these aerial propellers carried well above the deck on standards. To actuate the propeller a dynamo is provided which is carried on the top of the frame and is connected by gearing with the propeller shaft. In this place frictional cone gearing might be advantageously adopted, so as to admit of a variation of speed. The blades of the propeller should be of steel accurately shaped and arranged to be turned at greater or less angles according to the direction of the wind. To drive the dynamo, a lead of an electric circuit is carried along the bank, upon which line runs a trolly. Wires extend from the trolly to the dynamo, or the circuit may be completed through the earth, the body of water in the canal offering the best possible facilities for grounding the motor circuit. Thus equipped, a canal boat could make her way with a speed exceeding that generally used, and with no greater proportionate expenditure of power than that existing in all cases where the trolly system of actuating electric motors is in use.

The advantages of the system are obvious. The hull of the vessel would be entirely clear of machinery, and the entire weight of the propelling apparatus carried by the boat need not greatly exceed that of an ordinary tow rope. No disturbance of the water of the canal would be produced, except such as would be due to the progressive motion of the hull of the vessel. It would seem as though in this suggestion might be found a solution of the mechanical driving of canal boats; one that from the points of view of simplicity, non-occupancy of the hull of the boat, and minimum disturbance of the water, would be nearly perfect.

The air propeller works with an entire absence of vibration. It requires ten or twelve times the area of the corresponding water screw. The blades may for the first reason be carried out to the tips of increasing width. As the thrust is a perfectly quiet one, and if due to the motion derived from a dynamo would be free from the jarring inseparable from the motions of a heavy reciprocating engine, and as it is cushioned in all its motions by the high elasticity and mobility of the air, a very light frame would suffice to carry the wheel. The thrust of seventy-five to one hundred and fifty pounds would be all that the frame would have to resist —a thrust which would always be brought upon it gradually and would be gradually released. In steam canal boats a very considerable portion of the hull is occupied by the engine, boiler, and coal bunkers, while the constant eddies and currents produced by the propeller are destructive in their effects on the sides and bottom. This is all done away with in the aerial propulsion. The establishment of a line of poles and wire would not represent the tithe of the cost of a fixed or traveling towing cable.

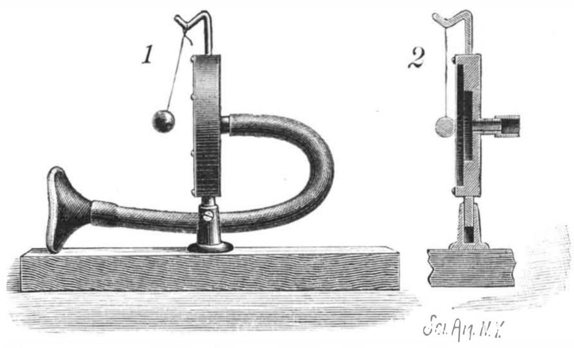


A SUGGESTION IN CANAL BOAT PROPULSION.

VIBRATIONS OF DIAPHRAGMS.

BY GEO. M. HOPKINS.

The telephone and phonograph show conclusively that the human voice is able to set certain bodies in active vibration. These vibrations may be detected by touch, but they are not discernible by the unaided eye. It has been shown that the force which produces them is able to perform a considerable amount of work. A telephone diaphragm is able to vibrate sufficiently to transmit speech, even when heavily weighted. A diaphragm, when placed in a horizontal position and damped by a five pound weight suspended from its center, transmitted speech equally as well as one not so damped, the only difference being a considerable loss in the volume of sound.



EXPERIMENT SHOWING THE VIBRATION OF A DIAPHRAGM.

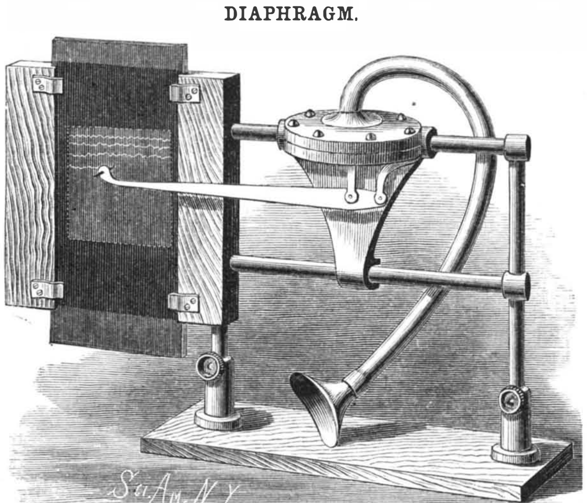


Fig. 3.—PHONOGRAPHIC RECORDER.

Mr. Edison some years since devised a piece of apparatus known as the motophone, in which a diaphragm vibrated by the voice was made to rotate a wheel at a high velocity. In the phonograph the cutting stylus, which is moved by the diaphragm, exhibits, when in action, something of the power of the voice, and the engraving on the cylinder of the phonograph shows the complex character of the vibrations of the diaphragm, but on so small a scale as to be difficult of observation.

The use of the apparatus shown in the annexed engravings is, first, to show by means of the lantern that the telephone diaphragm vibrates, and, second, to exhibit by the same means the character of the vibrations.

In Fig. 1 is shown a telephone diaphragm arranged upon a standard and adapted for projection. This apparatus is shown in section in Fig. 2. To the top of the diaphragm cell is secured a hook which supports a small metallic ball opposite the center of the diaphragm by means of a fine silk thread. The ball hangs normally in contact with the diaphragm, but when sounds are uttered in the tube attached to the cell, the diaphragm is vibrated, its motion being made manifest by the repeated repulsion of the ball.

In Fig. 3 is shown an instrument for tracing upon a smoked glass a record of the movements of the diaphragm. A wooden frame is supported by a standard secured to the base board. The face of the wooden frame is grooved to receive the smoked glass plate, which is held in the groove by four spring clips, so that it may be moved up or down after each tracing, preparatory to making a new one. In one edge of the frame are inserted two parallel rods, which are further supported by a standard attached to the base. The standards are made adjustable to adapt the instrument to lanterns of different heights. The arm which supports the diaphragm cell is provided with a sleeve which slides freely on the upper rod, and it is furnished at its lower end with a fork which partly embraces the lower rod. By this arrangement, the diaphragm cell is truly guided while the tracing is being made, and at the same time the construction allows of tilting the cell whenever it is desirable to remove the tracing point from the surface of the glass. The diaphragm cell consists of two chambered recessed disks fastened together with screws, and clamping between them a thin iron diaphragm. The upper disk is apertured and provided with a flexible tube terminating in a mouthpiece. To the center of the diaphragm is attached a stud, which is pivoted to the tracing lever, the lever being fulcrumed in a rigid arm projecting downward from the cell. The free end of the tracing lever carries a fine cambric needle, which lightly touches the surface of the smoked glass when the cell is in the position shown. The tracing lever is made of a thin bar of aluminum, which can spring laterally, but which is very rigid in the direction of its motion.

When used, the apparatus is placed with reference to the lantern so that the opening of the wooden frame will come within the cone of light in front of the condenser. The smoked glass is focused on the screen, the diaphragm cell is placed near the wooden frame and held in one hand, while the mouthpiece at the end of the flexible tube is held at the mouth by the other hand. Now, while a sound is made in the mouthpiece, the diaphragm cell is quickly but steadily drawn along, so as to cause the tracing needle to traverse the smoked glass. A sinuous line will be formed upon the glass, which will be characteristic of the sound uttered, and this line will appear upon the screen as it is formed. By tilting the diaphragm cell, and moving the smoked glass, and then returning the cell to the point of starting, the operation may be repeated. It will thus be seen that, by means of this instrument, a sound may be produced and analyzed at the same moment.

MOSS MARBLE.—There has been discovered, four miles south of Rattlesnake Springs, Washington Territory, an extensive ledge of marble, in which beautiful trees or plants of moss are as frequent and as clearly defined as in the moss agate, though the marble is not translucent. The body of the stone is mostly white, with splotches of pink and blue between the bunches of moss.

Ship Channel between Quebec and Montreal.

The close of ocean navigation of the St. Lawrence was appropriately marked by the official opening of the new 27½ feet channel between Montreal and Quebec, the Montreal Harbor Commissioners, the Minister of Public Works, and their friends making the opening trip on the Allan steamer Sardinian on November 7. The great work has been in progress more or less rapidly for fifty years, for in the year 1838 it really commenced, and though in some years it has gone on slowly, it has never been wholly interrupted from that date. Previous to confederation, in 1867, the work of improving and deepening the channel, especially through the flats of Lake St. Peter, had been carried on partly by the government of the then Province of Canada, partly by commissioners appointed by the government, partly by commissioners acting as agents for the Public Works Department, and after 1851 by the Harbor Commissioners of Montreal.

In November of that year a channel was completed with a minimum depth of 14 feet, excepting in Lake St. Peter, where there was only 12 feet, their operations in five months having increased this latter 2 feet. In 1853 there was a channel entirely through these flats 150 feet wide and 16 feet deep, and by 1865 this was 20 feet deep and 300 feet wide, at which it remained for several years. In 1873 an act was passed in the Dominion Legislature authorizing the Department of Public Works to complete this channel to a depth of 22 feet at low water, and not less than 300 feet wide, the Harbor Commissioners acting under the authority of the Board of Works, the interest on the loan being paid out of the revenues of the port of Montreal. New plant was purchased and set to work in the spring of 1875, and was kept steadily at work until the close of 1878, when a minimum depth of 22 feet at ordinary low water had been attained. Up to this time the cost of the new dredging plant had amounted to $524,000, and the working expenses had been over $628,600, or together $1,152,600.

In view of the rapidly increasing size of Atlantic steamers it was then decided to deepen the ship channel to 25 feet at low water, which was completed in 1882, excepting for two short lengths. In the straight parts of the channel the dredging was 325 feet wide in Lake St. Peter, and elsewhere 300 feet wide, but in bends and at important points it is 450 feet wide or more. The quantity of dredging done in lowering the channel from 20 feet to 25 feet was: Shale rock, 289,600 cubic yards; earth of all sorts, including bowlders lifted by the dredges, 8,200,000 cubic yards; and large bowlders, lifted by stone-lifting barges, 16,700 yards; making in all 8,508,400 cubic yards. The total distance dredged for the 25 feet channel was 34·30 miles, besides five miles of lateral channels. The longest piece of continuous dredging is through Lake St. Peter, the flats of which are 17¼ miles in length, involving the removal since the beginning of dredging in the present channel in 1851 to 1882 of about 8,000,000 cubic yards. The outlay for the deepening from 20 feet to 25 feet was: For dredging plant, $534,809, and for working and other expenses, $1,245,321; or a total of $1,780,130.

No sooner was this depth of 25 feet obtained than the increased size of the steamers frequenting the ports made a further deepening necessary, and in 1883 authority was given for a further loan of $900,000 to enable the Harbor Commissioners to increase the depth to 27½ feet at low water, and this is the work that has just been brought to a successful completion. The returns for this year are not yet made out, but for the last fiscal year, ending June 30, 1887, the total number of cubic yards dredged was 1,341,486, as against 1,790,431 yards the year before. The quantity excavated in Lake St. Peter was 727,200 yards, costing the remarkably low price of 1·45d. per cubic yard. At Cape Charles, where the excavation is all through shale rock, where one dredge and a stone lifter were steadily at work, the cost was 16¾d. per yard for the dredge and 32d. per yard for the stone lifted. The plant employed in the works for the past three years has been seven elevator dredges, two spoon dredges, two stone lifters, nine screw tugs, and twenty-five barges. The following statement of the last date of sailing of the mail steamers from Montreal, their tonnage and draught, shows the gradual improvement:

		Tons.		Draught in feet.
1856	Canadian	1,045	Nov. 11	12·06
1858	Indian	1,154	" 13	16
1860	North American	1,137	" 20	18
1861	Nova Scotian	1,487	" 20	20
1865	Peruvian	1,899	" 15	17·02
1870	Moravian	1,527	" 20	18·09
1871	Scandinavian	1,811	" 21	18
1875	Sardinian	2,577	" 20	18·09
1877	Circassian	2,355	" 20	19·06
1880	Peruvian	1,854	" 22	22·03
1886	Parisian	3,445	" 19	21·08
1888	Pomeranian	3,211	" 23	23

A number of steamers have passed down the river during the last season drawing from 24 feet to 26 feet, and in no case this year has there been any accident or delay. The whole subject of the mail communication with Great Britain is now under the consideration of the government, and tenders are now being received for an accelerated mail service, which will bring to Montreal steamers of as good a class, as large in capacity, and as fleet in their passages as those now working from New York to England, for any of which there is now sufficient depth in the channel. The following statement shows the growth of the seagoing shipping trade from Montreal since the work of deepening from 20 feet at low water to 27½ feet was begun:

	1873. No.	1873. Tons.	1887. No.	1887. Tons.
Steamships	242	245,237	600	807,471
Ships	72	65,823	7	8,684
Barks	164	75,594	68	43,275
Brigs	18	4,660	2	1,118
Brigantines	59	8,581	7	2,031
Schooners	149	12,583	83	8,194
	704	412,478	767	870,773

The steamers have thus increased in average tonnage from 1,013 tons to 1,346 tons in fourteen years, while the proportion of steam tonnage compared with the total of all vessels has increased from 59 per cent to 93 per cent in the same time.—*Engineering.*

Wind Power for Flour Mills.

Although the question of employing the wind to drive flour mills is, in my opinion, a very important one, I have not seen any practical discussion of it in our milling journals. There are certain parts of this country where, as there is no available water power, while steam is too expensive, it would be not only possible but profitable to use wind power, but, so far as my observation goes, very few millers have any knowledge or appreciation of the fact. In other countries, European countries especially, wind-driven flour mills, and that of considerable capacity, are no uncommon sight. I know of one foreign firm operating two mills, one by steam and one by wind, who have assured me that the latter one was financially the more successful.

Of course, in advocating the use of wind power I do not pretend that it will compare favorably with such water powers as are found at Niagara Falls and many other points. I will say that in order to be successful and satisfactory, a windmill should be automatic in all its parts, and, further, should be so arranged that any department of its work can be carried on alone in case the power becomes at any time too small to operate the whole. This has been done in water mills with excellent results, and would be equally advantageous for a windmill. The air is hardly ever dead still, and a breeze that barely moved the leaves on the trees would give power enough to keep the grain elevating or cleaning machinery or corn and feed stone in operation.

Of course, it requires a very good man to run a windmill successfully, but there is no need of engineer, fireman, or fuel.

I would not advise anybody to build a windmill of small size, since no steady, uniform power can be obtained for it. The best work can be done in a mill of 150 or 200 barrels capacity, which should have a wind wheel at least 85 or 90 feet in diameter. No smaller wheel would be satisfactory. Furthermore, the wind is never steady close to the ground, but at a height of about fifteen feet it is more reliable. Therefore, the wheel should not come within that distance from the ground.—*The Roller Mill.*

Health Notes.

The *Sanitary News*, published at Chicago, contains every week sanitary notes, which every seeker of good health and long life will be wise in regarding. The following are from a recent issue:

DANGER IN WATER.—It is generally conceded by the medical profession that polluted drinking water produces more typhoid fever than any other cause, yet there is scarcely any one thing about which people are more careless and indifferent. The pollution commonly comes from the drainage of barnyards, privies, sink drains, stagnant pools, and the like into wells. The water from these nuisances being filtered through the soil, the pollution is seldom detected by the sight, taste, or smell. The board of health of one of the Eastern States, in a late annual report, gives an account of a well of water containing 49·2 grains of solids per gallon, yet the pollution could not be recognized by the senses, and several persons lost their lives by its use before the cause was discovered.

BAD AIR PRODUCES BAD HEALTH.—If you find frosted window panes, damp pillows and walls, and feel languid, with probably a slight headache when you wake on a cold morning, you can feel pretty sure that the ventilation is imperfect. At this time of year the air is frequently shut out to keep out the cold, and many suffer from the ill effects of an insufficient supply of oxygen and the breathing of air charged with carbonic acid and other deleterious substances thrown off by exhalation. The evidences of bad ventilation may not be decidedly marked, but the silent and insidious injury to health goes on. A family can be comfortable with less heat and more fresh air than is generally supposed, and in rooms heated by furnace or stoves and lighted by gas too much care regarding ventilation cannot be exercised.

SUNSHINE.—Equally important with pure air in living apartments is sunshine. It carries with it radiance and cheer and vigor and good health. It is a purifier, warding off mould, moisture, gloom, depression, and disease. It should be admitted to every apartment of the house, and made welcome at all times. It is a strong preventive to the disorders that visit shaded and musty places. It brings health and happiness that cannot be obtained from any other source. It is nature's own health-giving agent, and nothing can be substituted for it. It has no artificial counterpart. It does not only touch the physical body, but it reaches the mind and soul and purifies the whole existence of man. It may fade a carpet or upholstery, but it will bring color to the cheek, light to the eye, and elasticity to the step. The closed and shaded window may throw a richness of color upon the room, but it will bring paleness and feebleness to the occupants. This health agent is free to all, easily obtained, and one of the most economic health preservers we have, and ready to impart its efficacy at the rise of the curtain.

DANGER IN NEWLY BUILT HOUSES.—There is too great haste in occupying a house after its completion. In many places there is such demand for dwellings, and often business apartments, that, as soon as finished, they are occupied. This is especially true of small dwellings. There is more danger in this than is supposed. There is no health in dampness and mould under any circumstances, and in living apartments, where the tendency is toward poor ventilation, the dampness of newly finished houses contributes largely to ill-health. In the town of Basle, Switzerland, a regulation has been adopted which prevents newly built houses from being occupied until four months after completion. Under many circumstances, so long a time as above specified is not necessary, but it is often well to err on the side of safety. The size of the house, its location, surroundings, the material used, and the state of the weather enter into the consideration of the time necessary in which a building should become sufficiently dry for occupancy.

Population of the Sandwich Islands.

The following table of the proportion of nationalities in the kingdom of Hawaii, that is, the Sandwich Islands, is from the Honolulu Almanack and Directory:

Nationality.	Males.	Females.	Total.
Chinese	17,068	871	17,939
White natives	1,068	972	2,040
Americans	1,198	868	2,066
British	882	460	1,342
Germans	1,039	561	1,600
French	125	67	192
Portuguese	5,239	4,138	9,377
Japanese	98	18	116
Norwegians	262	100	362
Polynesians	667	289	956
Other nationalities	330	86	416
	27,976	8,430	36,406
Hawaiians and half-castes	23,623	20,609	44,232

Petroleum for Fuel.

In speaking of petroleum as used in the United States for fuel, *Engineering* says:

"America, which waited so long to be taught by Russia how to use liquid fuel on a large scale, has at length rushed into the business with ardor, and promises before another year to forge ahead of her rival. Why the United States should have lagged so long is capable of easy explanation. When the oil industry was originally developed, their fuel was everywhere cheap, and no necessity existed for a rival to wood and coal. Moreover, the American raw petroleum gave so large a yield of kerosene and lubricating oils that no particular balance of refuse was left inviting utilization. It was for this reason that the Americans looked coldly on the liquid fuel progress of Russia, and made no attempt to beat it. A few years ago, however, large quantities of oil were found in the State of Ohio not very well adapted for refining purposes, although many efforts were made to render the distillation of kerosene a paying operation. At length the Standard Oil Company, to prevent competition in the refining trade on the part of the Ohio refiners, bought the whole of them out, and then proceeded to utilize its monopoly by making arrangements to pipe the oil to Chicago for fuel purposes."

This line is 270 miles long, and the oil is supplied through an eight inch pipe. As the use of oil is far preferable to the use of coal in some industries, there was an immediate demand for the fuel as soon as it was offered at Chicago. Appliances for the consumption of oil were at once introduced, some of them copied from the Russian type and some modified and some original in construction, in order to meet the requirements of the local factories.

The three methods most generally employed for the combustion of the petroleum is the distilling the oil in a gas plant until it is reduced to a gas, after which it is burned under boilers similarly to natural gas. Another method is forcing the oil in a spray under the boiler by compressed air. Perhaps the most usual method, however, is spraying the oil into the furnace by an injector operated by a jet of steam, where it becomes vaporized and mingles with the air which is also thrown from the injector.

RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE.—Lewis C. Huson, Elmira, N. Y. In this engine the piston is formed in sections having their inner edges constructed to loosely interlock with each other, whereby the sections are connected together and yet may move to a limited extent independently, the valves allowing for operating the engine in either direction.

ROTARY ENGINE.—The same inventor has likewise patented a compound engine having three separated chambers, each with a piston head, and all the heads fixed on the same shaft, live steam being supplied to two of the chambers, and the exhaust therefrom discharging into the third chamber, the invention also covering a novel construction of the drum to increase the bearing surface for the steam without diminishing the guide surface of the piston.

SAFETY VALVE. — Francis X. Vien, Brooklyn, N. Y. This valve is mounted to slide vertically, a pin bearing in the center of the valve and a weighted lever pressing on the pin, the valve having downward projections for guiding it in its seat, and the invention also covering novel details and combinations of parts.

BOILER CLEANER.—William T. Haney, Childersburg, Ala. This cleaner consists of a brush having a block or body formed on its upper side with a beveled or inclined surface, arranged to be acted upon by the water as the brush is reciprocated, to force the brush against the boiler surface, it being intended to be operated while the boiler is being used.

WATER ELEVATOR.—William O. Lentz, Mauch Chunk, Pa. This invention covers novel constructions and combinations of parts for pumping water from shafts or slopes in mines in which an air pump arranged above is used in connection with a series of successive lifting columns or pipes fitted with suitable valves and connected with the pump.

BURNER.—James Gibbons, Jersey City, N. J. This is a device adapted to burn fluid fuels, coal or water gases, wherein the air supply to the burner is superheated and the volume of air may be regulated to a nicety prior to its commingling with the fluid fuel in the mixing tube, and passing thence with the fuel to the point of ignition to produce an intensely hot flame.

Mechanical.

MASON'S FLOAT. — George Kautz, Albany, N. Y. This is a float of which the handle may be easily and quickly attached or disengaged at pleasure, the parts being so made that the blade will be held firmly by the handle without the use of nails, so that the blade may be worn completely out and the handle then used with another float.

PATTERN WHEEL. — James Keeton, Brooklyn, N. Y. This is a wheel for warp knitting machines used in making gloves, mitts, and like articles, and the invention covers a novel construction of the wheel and means for holding and adjusting the blocks, whereby they may be independently set in or out relatively to the center of the wheel, to change the pattern as required.

NUT LOCK.—Thomas W. Patten, Baltimore, Md. This device consists of a screw-threaded nut having an eccentric depression in one side, combined with a washer having an eccentric boss projecting laterally therefrom, and having on its inner periphery transverse teeth adapted to engage transversely the threads of a bolt.

Agricultural.

POTATO DIGGER.—Hiram M. Shaw, Genoa, N. Y. As this machine is drawn forward, a fork is oscillated vertically by mechanism driven from the sulky wheel, and the potatoes and earth dislodged by the hoe are passed on to the fork, where they are thoroughly separated and the potatoes left on the top of the ground, where they can be conveniently gathered.

Miscellaneous.

PRINTER'S BRUSH.—Joseph C. Israel, New York City. This brush has a liquid-containing vessel or compartment arranged in its top or back with a valve designed to allow small quantities of the liquid to be delivered to the bristles through the bristle-holding apertures, being especially adapted for use in cleaning printers' forms with benzine.

DUPLICATING TABLET. -- William H. Pardee, Columbia, Dakota Ter. Two books are secured to one back by independent fastenings, with their leaves alternating with each other, a carbon paper being secured to the back and adapted to be folded in between the leaves, whereby salesmen and others may keep a record in duplicate of checks and memoranda made out.

TEMPORARY BINDER.—The same inventor has patented a temporary binder for holding leaves or tablets or for filing bills, the cover having two studs combined with a rock shaft having curved arms adapted to act in conjunction with the studs in holding the paper on the cover, a second cover being connected with the first by a link, and having recesses to receive the curved arms.

STOVE OR RANGE.—Henry E. Janes, New York City. According to this invention a grating is located at each side of the grate between the upper oven plate and the top of the stove, with a concavity in its rear edge to embrace the pipes of the water back, whereby coal and cinders will be effectually prevented from passing from the grate to the flues.

SASH HOLDER. — Henry A. Flatman and James Seed, Southbrook, New Zealand. Combined with the casing is a friction piece, a lever pivoted to the casing supporting the friction piece, which is also engaged by a spring, the device being applicable to window sash and sliding blind sash, and forming a clamp to prevent rattling.

FENCE MACHINE. — John Sornson, Brayton, Iowa. This device comprises a body portion, with arms hinged at intervals upon one face of the body, the arms having a transverse groove in opposite sides near their free end, and a clamping fork extending across the grooves, making a simple and effective means for wiring in pickets or planks to make a fence.

MOVABLE DAM. — Addison M. Scott, Charleston, West Va. This invention covers an improved construction of dams which are composed of a series of wickets or shutters, which, when erect, form the dam, being then braced by a prop, movable as the dam is raised or lowered, the improvement relating especially to the "heurter" and the down-stream "slide."

LIQUID HOLDING VESSEL.—Stewart R. Mace, Moulton, Iowa. This is a pivoted can with a hollow handle and upwardly projecting spout, with its end in alignment with the spout, there being a valve for closing the spout and another between the handle and can, whereby the can may be readily manipulated and its entire contents emptied without danger of spilling.

INSULATOR.—Warren C. Brown, Tarrytown, N. Y. This insulator is formed of two halves, each having a semicircular groove, one half having also a lug and the other a recess for causing the grooves to register when clamped upon a wire, which may be done without the use of binding wires, the insulator to be made of glass, vulcanite, or other suitable material.

COCOANUT COMPOUND. — Leopold Schepp, New York City. This is a compound in which granulated dried cocoanut is mixed with granulated sugar, granulated tapioca, granulated baked corn, and other ingredients, in specified proportions, to make an article ready for use as a pie-filling or other purpose, but mainly for cocoanut tapioca puddings.

COCOANUT COMPOUND. — This is another food compound by the same inventor, having cocoanut, sugar, starch, gelatine, flavoring extract, and other materials, and being more especially adapted for use as a cocoanut cream pudding, the compounds being both designed to be put up in small sized air and water tight packages in convenient form for family and hotel use.

LINIMENT. — David Bates, Bonham, Texas. This liniment is made of linseed oil, turpentine, sulphuric acid, oil of wintergreen, tincture of button snake root, and other ingredients, to form an antiseptic compound for the treatment of all kinds of wounds, lame joints, etc., and is also designed to act as an insecticide.

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.

(447) H. W. C. asks (1) whether the wire on the eight light dynamo is single or double would. A. Double covered. 2. Whether the rings of armature will make any difference if the hole is 1⅜ inches instead of 1¼. I have the rings with 1⅜ hole, and find that it is lots of work to turn them out. A. It will make no difference.

(448) Subscriber asks: 1. Would annealed steel wire do for the armature core? A. No. 2. Can the motion of the motor be changed by reversing the current? If not, how can it be reversed? A. No. You must shift the brushes. 3. Can more power be developed if two of such motors be coupled to one or the same shaft, and the current be run through both? A. Probably not with the same current.

(449) G. C. asks for the best method of eating copper wire from silver work without injuring the silver. A. Immerse in muriatic acid and add to it a little nitric acid. Or heat in chloride of copper solution. In using first method be careful to use as little nitric acid as possible, with a good excess of muriatic all through the operation.

(450) B. F. M. asks (1) whether the dynamo described in SUPPLEMENT, No. 161, can in any way be run as a motor. If so, how can it be done? A. The dynamo referred to works well as a motor, but it would work better if two or three layers of the winding of the field magnet were omitted. 2. Can the stumps of electric light carbons which have been used be utilized in making a battery? A. Yes. See SCIENTIFIC AMERICAN, Dec. 17, 1887, and Oct. 27, 1888.

(451) Advance.—We advise you to consult Herring's Dynamo Electric Machinery for the information you desire.

(452) A Tyro asks if dynamo described SUPPLEMENT, No. 600, can be used as a motor, and if so, of what power with a current of say 110 or 220 volts. A. The dynamo referred to will develop about one horse power.

(453) A. F. W. asks for the best and cheapest way to amalgamate zinc, used in Bunsen battery. A. Place a very little mercury and some dilute sulphuric acid on a plate. Wet the zincs with acid and rub them with the mercury, using a piece of galvanized iron to pick it up. Or you may get a little mercury to adhere to one zinc and then may spread it by rubbing one plate against the other.

(454) L. D. Le N.—It is impossible to identify a plant from merely a strip of cuticle taken from the stem. It will be necessary for you to send the flowers and leaves of the plant, properly pressed and dried, and inclosed between sheets of cardboard to prevent breakage during transmission.

(455) M. H. N. asks: How can I etch my name on a lantern globe? Also, what acid is used for etching on steel or iron? A. Paint all around the letters of your name with black varnish, and protect the rest of the glass with paper. Let fall from a funnel a small stream of emery, about No. 50, upon the letters of the name. When sufficiently cut, clean off the varnish with turpentine. Also see query 456. Use weak nitric acid to etch steel and iron.

(456) H. E. B. asks: 1. How much water would waste from a boiler carrying 100 lb. of steam, through a hole in the boiler of 1-16 inch in diameter? Also through a hole of 1-32 inch in diameter in one hour's time? A. Provided the holes were straight and round, the discharge would be 45 gallons per hour from the 1-16 inch hole, and 11 gallons per hour from the 1-32 inch hole. 2. About what per cent of power is utilized in that class of small water motors that run by having a stream of water (under pressure) play against the cups on the rim of the wheel? There are several in a neighboring town, run by water from the city water works. A. 55 to 60 per cent for wheels with open buckets. With jacketed buckets running in a case, or with concave buckets or cups, the power realized may rise to 75 per cent. 3. Supposing the water wheels were made hollow, and from projecting arms the water was ejected backward from the way the wheel was running, and so run by reaction, would it not give just as much power as does the present style of wheels that run by direct action, same as the wheels in my second question? A. In the reaction wheels as high as 80 per cent has been claimed. There is a mechanical difficulty in connecting the supply through the shaft, that interferes with their usefulness. 4. In the electric blowpipe described in SCIENTIFIC AMERICAN of February 2, if the other end of the magnet was presented to the arc, would it repel the arc same as it does in that figure? A. Both poles are repellent to the electric arc. 5. Of what does the arc consist? Of fine particles of carbon? A. Fine particles of carbon are carried between the points by the electric current.

(457) D. E. W. asks: 1. Is Brown & Sharpe's wire gauge the same as the American wire guage? A. Yes. 2. In the simple electric motor will it hurt the working of it if I paint the coils on the field magnet and armature? What kind of paint shall I use? A. No. Use shellac varnish, with any pigment to suit. 3. By the word "abut" do you mean to overlap or simply touch? A. To touch at the ends. 4. If the armature ring is wound with No. 18 wire, should the field magnet be wound with No. 16 or 18? A. No. 16. 5. What is a shunt? A. A branch circuit. 6. In a Leclanche battery of what are the pieces on each side of the carbon plate composed? A. Black oxide of manganese and a small quantity of shellac. Another formula gives the following: Oxide of manganese 40 parts, carbon 52 parts, gum lac 5 parts, bisulphate of potash 3 parts, compressed at 300 atmospheres at 212° F. 7. Would the whole carbon surface of a Leclanche battery be enough for one cell of the bichromate plunge battery? A. Yes; but it is not in the right form. 8. Could you give me simple instructions for making a storage battery for experimental work? A. Consult the SUPPLEMENT.

(458) F. W. T. asks how to go to work to make a vacuum, and what machinery would be necessary and where obtained. A. You can produce a partial vacuum by driving the air out of a vessel by means of steam, then condensing the steam; also by means of an aspirator or air pump. If you want a high vacuum, you must use a Sprengel or Geissler air pump. You will find the names of dealers in vacuum machinery in our advertising columns.

(459) H. H. A. writes: 1. Is it advisable or possible to use two different styles of batteries on an electric bell circuit, for instance, the Leclanche and Gassner's dry battery? A. It is not generally done, but the combination mentioned might answer. 2. Which is the best battery for ringing bells? A. For open circuit work the Leclanche or some form of salammoniac battery is generally employed. For closed circuit a bichromate couple is most economical.

(460) E. B. K. writes: Are hens' eggs manufactured in any artificial way, and sold in the market, so as to represent the genuine article? A. No; but dried eggs are sold for use in cooking.

(461) W. C. asks: Can you recommend any method for taking out the lead from the grooves of a badly fouled rifle? Have tried coal oil and turpentine. Is there no chemical which will dissolve the lead and not injure the rifle barrel? A. Clean the inside of the barrel with a strong solution of caustic soda, wash with hot water, and close one end with a pine plug. Pour into the barrel 2 or 3 ounces mercury, plug the end, lay the barrel level, and occasionally turn it over, so that the mercury may come in contact with all parts. In a

few hours it will be ready to clean in the usual way with swab and good petroleum oil, or cylinder oil if it can be obtained.

(462) J. M. S. asks by what process the shades of an ordinary student's lamp can be dyed in red, blue, and green. A. Give the shades a thin coat of oil paint of transparent quality, such as carmine, Prussian blue, gamboge, etc. If there is trouble in applying the paint, first go over the glass with a solution of egg albumen in water, and paint when perfectly dry. Or dissolve gelatine in water, color with aniline colors dissolved in alcohol, and paint with this. The latter will sooner or latter fade, and will possibly flake off under the effects of heat.

(463) J. A. S. asks: Will any amount of German silver resistance wire in a circuit annihilate the force of current? To your knowledge, is there any electric lamp in which the light may be gauged like an oil lamp? A. A resistance coil of German silver or other wire will reduce the force of an electric current, but at the expense of energy. No practicable lamp variable in intensity is on the market. The only method to reach such a result would be in some way to alter the amount of filament heated.

(464) C. F. H. asks (1) how to clean ivory keys of a piano that have grown a little yellow. A. You might try sponging them with hydrogen binoxide. Possibly gentle rubbing with whiting and water would improve them. 2. A good polish for the outside case. A. Rub with the palm of the hand moistened with water and sweet oil. See answer to query No. 197. 3. Also a good receipt for good bass violin resin. A. See answer to query 297.

(465) J. F. S. says: I have a boat 25 feet long, 4 feet 11 inches wide, 20 inches draught. What would be a good sized engine to put in it? Which would give the better satisfaction—coal or oil fuel? What heating surface do I require for an engine 3½×4 to give good satisfaction? Has a coil boiler any advantage over a porcupine? A. Your boat requires a 3 horse power engine. The size of your engine is right, and will require 42 square feet of heating surface for satisfactory work. Oil fuel as applied by the Shipman Engine Company is a very satisfactory arrangement. We do not know of any advantage of a coil boiler over the "porcupine" form for a boat.

(466) P. H. R. asks: 1. Is there any better material than common white glue for putting together a violin? A. Use glue. 2. What is the best material for finishing and polishing the same? A. Stain with alcoholic solution of gamboge, give the violin twelve or fifteen coats of varnish, and finish if desired by polishing with a little oil and pumice, followed by dry tripoli and a silk cloth. The varnish must dry several weeks before polishing.

(467) R. W. P. writes: 1. What is the candle power of a common Argand lamp? A. 12 to 20 candles. 2. Will 2 two-quart Bunsen cells run an 8 candle power incandescent lamp, and if not, how many will? A. No. Six or eight will be required. 3. Are there Edison 8 candle power incandescent lamps manufactured? A. Yes.

(468) Machinist writes: Will you kindly through your paper give the rule for finding dimensions of safety valve for boiler, that is, proper size, the boiler should have? A. By the regulations of the United States Board of Supervising Inspectors, safety valves for marine boilers shall have an area of not less than one square inch to two square feet of the grate surface in the boiler. The practice among engineers varies somewhat for stationary boilers, some assigning one square inch area of valve opening to 25 square feet of heating surface. This is a good rule, but as the trade sizes of safety valves are of fixed areas, it is always safe, when the computation falls between any trade size, to adopt the next size larger.

(469) H. L. S. asks (1) for a good recipe for a mixture to be used for soap bubbles; a cheap enough one if possible, so that it could be used in large quantities for a soap bubble party. A. Cut up Castile soap into fine shavings, place one part in a clean bottle with 40 parts of rain water, and let it stand for a day with repeated shakings. Let it settle a few hours and pour off the clear solution; if necessary, filter through flannel. 2. Also is it dangerous to blow bubbles filled with hydrogen in the vicinity of electric lights? A. No.

(470) P. C. M. writes: Will you please give receipt for making a stencil paint—color, black? Something to be applied to a painted surface and to receive a coat of varnish as a finishing coat. A. Make the stencil paint with lamp black and turpentine and add a little varnish, only enough to prevent the stencil mark from spreading when the varnish is applied.

(471) W. W. M. asks: 1. Will the simple electric motor in SUPPLEMENT, No. 641, answer for a dynamo? The direction of the current seems to be the same. A. Yes. Use finer wire on the armature, and make the field magnet of cast iron. 2. Will soft iron do for the field magnet of a dynamo, or must it be cast iron? A. Cast iron is preferable. 3. Will the commutator and drum armature used in the motor do in constructing the eight light dynamo? It is so much easier made, especially the commutator. A. Yes. 4. If so, will it be better to have 24 coils and 24 screws in the armature and commutator than 12, as in the motor? A. Yes. You can economize space by widening the brushes and arranging the screws zigzag.

(472) F. F. Z. asks for a good receipt for aquarium putty. A. Mix 15 parts Burgundy pitch with 3 to 4 parts gutta percha in shreds. 2. What is used to polish cuffs? A. A heavy highly polished iron. A little spermaceti or paraffine may be mixed with the starch. 3. What would an electric plant with a gas or water motor cost, enough to light up a store and 6 rooms, say 15 or 20 Edison's incandescent lamps, and what would the cost be a month to operate same? A. We cannot undertake to supply such estimates. Address some electric manufacturing company. The cost of running would depend on the price of gas or of water power.

(473) J. D. M. writes: Can you tell me how to analyze mixed paints? Is there any work that will give me the desired information, both qualitatively and quantitatively? A. Quite troublesome problems in chemical analysis often arise in the analysis of paints. A good knowledge of analytical chemistry is required, which books alone will not give. We can supply all desired works, such as Shepherd's Chemistry, $1.50, or books on paints, such as Condit's Painting and Painters' Materials, $2.25, free by mail at the regular prices.

(474) E. J. O. writes: I have made an induction coil 4 inches long with a No. 18 primary wire, and the secondary of Nos. 34 and 36 wire. It gives a powerful shock with one cell battery, but is felt stronger in one hand than in the other. Would like to remedy this trouble. If not too much trouble, will you please tell me what is the matter? Did I do right in using two sizes wire in the secondary? Also made a larger, using 1¼ pounds No. 36 wire, according to directions in SUPPLEMENT, No. 160. Although the coil would give with one cell Grenet battery a quarter inch spark, the shock could be taken much easier than that from the little coil when its spark was less than one sixteenth of an inch. Moreover, when sliding the core in the larger coil the strength of the current would gradually increase until the core was about half way in, when, on pushing the core in still further, the current became weaker. Will you also please inform me what was wrong in this case? A. It is possible your trouble may be in your hands rather than the coil. One hand may be more sensitive than the other, or one hand may have been dry and the other moist. Although one size of secondary wire is preferable to two sizes, the difference will not be noticeable in your small coil. Possibly you do not use current enough or perhaps your core short circuits the primary coil.

(475) J. W. P. writes: I have completed the dynamo described in SUPPLEMENT, No. 600, but have made it two inches longer. The current started with one Bunsen cell, it seems to give a strong current. It melts 13 inches of No. 32 iron wire. Had no lamps to try its power. I would like to ask a few questions through Notes and Queries. 1. How shall I connect it up to get the best result for arc or incandescent lamps? A. Add two more layers of wire to the field magnet and connect it up as a shunt machine with a variable resistance in the circuit of the field magnet. 2. How are the wires on field magnets numbered? Do Nos. 1 and 5 represent the outer and inner ends of the first or of the last coil? A. Nos. 1 and 5 represent the beginning and end of the first coil, Nos. 2 and 6 the beginning and end of the second coil, and so on. 3. How many amperes and how many volts ought it develop if run at say 2,300? It has 15½ pounds of No. 18 wire on field and 3 pounds of No. 20 on armature. A. A current of about 10 amperes with a pressure of about 75 volts. 4. What number and length wire is used in making the Wood ammeter and voltmeter described in SUPPLEMENT, No. 628? A. We have no information other than that published.

(476) F. J. K. asks: 1. What preparation and how made (or in what proportions) should be used for the inside of the egg chamber of an incubator (made of yellow pine), that will be proof against moisture and heat, to prevent the wood opening and swelling? A. Two or three coats of shellac varnish will keep moisture from penetrating the case of an incubator. 2. What is the best non-conductor that can be used between the two cases of an incubator? A. For an insulator use cotton wool or powdered charcoal. 3. What can be used to bring out the grain of yellow pine and at the same time oil and harden it, and how done? A. Shellac varnish one coat and oil with boiled linseed oil or varnish with clear copal. 4. Will moisture be prevented from forming between the glasses one inch apart if they are put in air tight? A. Put the glasses in place in cold dry air, and, if tight, they will not show moisture. See answer 203.

(477) F. W. writes: Astronomers claim that the moon's surface is subject to a degree of heat corresponding to about 500° of Fah. scale, when exposed to the sun's rays, and that it cools down to 250° below zero when not so exposed. How can that be, when it is also claimed that the moon is without an atmosphere? How then about the eternal snows on Mont Blanc and other high mountains, a fact accounted for by a rarefied atmosphere? A. The sun shines on any spot on the surface of the moon for about 14¾ consecutive days, and during the long lunar night, in length equal to the day, the radiation is very great. The absence of aqueous vapor from the moon is one great cause of the difference, which is fairly computed, as stated in astronomy, from the known effects of solar heat by day and radiation by night, as observed at high altitudes, on the earth, at which points there is little air and aqueous vapor between the ground and the sun.

(478) G. A. B. writes: I have a dried antelope hide. It is quite stiff and somewhat offensive in smell. What shall I do to make it soft and pliable, suitable for a rug or a cushion, and how deodorize it? A. To tan skins with hair on: Soak the dry skin from 12 to 16 hours in water, then scrape off all flesh and return to fresh water for 8 hours longer. Wash in warm water with enough sal soda to make the water feel slippery to the fingers. Wash in warm soap water, and rinse through two or three waters. Make a solution of 2 gallons water, 2 pounds Glauber's salt, 1 pound alum, 1 pound salt, ½ ounce sulphate zinc, 1 pound terra japonica, by heating over a slow fire. Immerse the skin in the cold solution and handle by pulling and stretching for three to four days, then rinse through three clean waters, wring as dry as possible, and hang up to dry. When nearly dry, work the skin to soften it by the hands or on a bench, and stretch on a board or table.

(479) L. D. C. writes: 1. Which is the most reliable and (if possible) simple continuously self-registering thermometer? I understand that metallic thermometers, as generally constructed, are not sensitive enough to register slight variations of temperature—1° to 2° Fah. A. We think that you will find a registering thermometer by a first class maker, such as Negretti & Zambra or Green, is accurate to fractions of a degree. 2. There is a device for photographing the thermometer indication, which consists of a piece of sensitive paper, moved behind a thermometer by clockwork, and acted upon by the rays of light admitted over the column of the thermometer. But the question arises: Can the aperture admitting the light to the sensitive paper be adjusted easily in such a way as to prevent the light from passing on the sides of the column? A. The column can easily be photographed, the spaces at the side of the column can be easily masked, and the entering rays parallelized so as to avoid parallax errors. 3. Which is the best sensitive paper to be used in connection with the above device, and how prepared? A. Gelatino-bromide paper would be excellent. 4. What is the most reliable and recent text book on physics? A. Daniell's Physics, $3.50, or Ganot's Physics, $5.00, which we can send by mail at price named.

(480) A. writes: Please give a receipt for taking out writing, something that will not injure the paper; also is there not a chemical that would restore the original if applied? A. An excellent method is to use heavy blotting paper soaked in oxalic acid and dried. Slightly moisten the writing and press this on it, repeating the moistening and application of the paper until the ink disappears. Afterward moisten and dry with plain blotting paper. The ink cannot be restored if thoroughly erased. Moistening with an infusion of nutgalls may restore it to some extent if any iron oxide is left on the paper.

(481) B. F. S. writes: If any of your readers have tried to run dynamo with a windmill in connection with a secondary battery, will they kindly give results? I wish to light a private residence with incandescent lights, by wind power if practicable. A. By attaching to the dynamo an automatic regulator or cut-out, which will open the circuit when the speed of the dynamo diminishes beyond the prescribed limit, it is possible to charge secondary batteries by power derived from a windmill. Another plan would be to pump water with the windmill into an elevated tank, and run the dynamo with a water motor. 2. Do you consider the eight light dynamo described in SUPPLEMENT, No. 600, competent to do regular business? A. The dynamo is perfectly competent. 3. Which way would be the better one to wind it? A. Wind as directed.

(482) A. B. F. writes: In setting poles for electric light or telephone, what is the best preparation to prevent them from rotting in the ground? At what season of the year is it best to cut poles for above purposes? A. Soaking the ends of the poles in a strong solution say of 20 pounds sulphate of iron to 100 pounds water for 24 hours is probably the cheapest and most effective process for preserving wood that is to be placed underground. A tank of wood of sufficient width and depth to allow the ends of the poles to be immersed to the proper distance when raised at an angle, and of a length to accommodate as many poles as will furnish the necessary supply for the progress of the work, is all the appliance needed, save the solution. Creosoting is better, but requires expensive apparatus for its application. December and January are the best months to cut telegraph poles.

(483) J. A. B. asks: 1. What kind of paint is used in decorating glassware, and what amount of heat is required to bake it on? A. Mineral paints composed of various oxides, such as iron, cobalt, or manganese oxides, are used. A full red heat is needed to bake them. 2. How to silver glass (hollow tubes). A. Make an alloy of equal parts of lead, tin, and bismuth, add the latter last, skim off the dross, and add to 1½ parts of alloy 5 parts of mercury; stir well. This amalgam, carefully introduced into a clean tube and slowly moved about, is said to give a good coating. Or you may use an ammoniacal solution of silver, 1 ounce nitrate to 1 pint distilled water and ammonia enough to redissolve the precipitate first formed on its addition; then add ¼ ounce honey. Fill the tube with this and boil it for 10 to 30 minutes. 3. How to etch on glass? A. Coat with melted beeswax, draw the design through the wax, and expose to the vapors of hydrofluoric acid generated in a lead pan from a mixture of fluorspar and sulphuric acid. Also see query 444.

(484) W. F. W. asks: 1. When a secondary battery of 20 cells is fully charged, for how many days, for four hours each day, will it supply a current for one 16 candle power incandescent lamp? A. It depends on the size of cell. One typical cell gives 350 ampere hours. A fifty volt lamp would require rather less than 1½ amperes of current, so that the battery in series would last 250 hours or for about two month as you use it. 2. How many hours will it require to charge such a battery with a dynamo giving a current equal to 10 Bunsen cells? A. The data are insufficient. You can charge it at about 38 amperes and 2½ volts in ten hours; for less amperage in proportionately more time. 3. Will the light be just as brilliant when the battery is nearly exhausted as at first? A. Yes; up to near the end. 4. How can one determine when such a battery is fully charged? A. By the specific gravity of the solution and by gas coming off, or by means of a current meter.

(485) W. P. A. writes: I have just had a discussion with a party who holds that a locomotive running at the rate of forty miles an hour will require less force to keep up that speed than it would to keep its speed if running only one mile an hour. I contend that the force required would be the same, if it were not for the increased atmospheric friction that would have to be overcome by the faster locomotive. A. The journal friction due to variable locomotive or train speed, within certain limits, is nearly a constant. At velocities of the bearing surfaces of about 15 feet per second, M. Poiree found that friction seemed to decrease slightly with increase of velocity. Train resistance at increasing speeds is made up not only of air resistance against the cars, but every moving surface that goes to make up a train, including engine and tender, wheels and axles, as well as all reciprocating parts, partake of the air resistance to motion. The inequalities of track, imperfections of wheel tread, and vibration in all parts of engine and train add to resistance as the speed increases.

(486) J. B. writes: Could you give me any particulars as to how the marbled appearance is given to the wrought iron gray enameled hollow ware, such as used for domestic purposes? A. The vessels are coated by dipping with a finely ground silicious frit mixed to the consistency of cream, with water. After this has dried perfectly, they are fired for a few minutes until the coating melts. The iron of the vessel rusts a little during the drying and this oxide dissolves in the enamel and produces the mottled effect which extends through the coating.

(487) A. E. S. writes: 1. I have made an induction coil and it does not work satisfactorily. Will you please be so kind as to tell me what the trouble is? A. For induction coil and construction and management of same, we refer you to our SUPPLEMENT, Nos. 160 and 569. 2. How long will a 16 candle power incandescent lamp last? How many hours? A. About 400 hours. 3. For what purpose are secondary batteries used, and of what manufacture are the best? A. Storage batteries are used principally for lighting, and also for driving motors. The Julien, the Plante, or the Electric Accumulator Company's batteries are all good.

(488) J. A. G. asks for (1) a waterproof non-heating substance for coating leather, that will allow common glue to adhere firmly. A. Glue itself on leather becomes waterproof. Coat the leather with glue size, adding, if you wish, one-tenth the weight of the dry glue of bichromate of potash to the solution, not exposing it to the light until applied. 2. A solution or means of cleansing old paint brush stumps, by steam or otherwise. A. Benzine, turpentine, or caustic potash. The latter must be weak, or it will attack the bristles.

(489) E. J. F. writes: 1. Will a plunge battery with six carbons 6×9 do to excite the field magnet for the hand power dynamo described in SUPPLEMENT, No. 161? A. Yes. 2. Do you connect the zinc to the carbon, or zinc to zinc and carbon to carbon? A. Zinc to carbon.

(490) M. A. C. writes: Can you tell me how I can color or dye cow horns? How shall I treat them to bend or shape them? A. Immerse in warm soap and water for a few hours, and then dye as you would any other material. To bend, subject them to boiling water and bend while hot.

(491) F. E. H. writes: 1. I have a medical battery which I work by a bichromate battery. My battery is uncovered, and the strength seems to evaporate. Is it necessary to have my battery covered? A. No. You need new solution, and probably should amalgamate your zincs. 2. When you make an induction coil for a medical battery, and wind it with two sizes of wire, do you connect the fine and coarse wires? A. No. Each coil is separate. See our SUPPLEMENT, No. 569, for full description of a medical induction coil.

(492) Amateur writes: 1. What is quickest method of manipulating wall papers previous to applying the AsH_3 test? I have been dissolving them in strong H_2SO_4, but think there is a neater way. A. Treat the paper with any strong mineral acid and filter after dilution, or dissolve in hot strong hydrochloric acid, adding from time to time a very little potassium chlorate until a clear solution is obtained. 2. Flashing point of illuminating oils. How obtained? A. Heat a dish containing a sample of the oil on a water bath, suspend a thermometer with its bulb immersed in the oil; sweep a very minute flame over the surface every few minutes until a flash is perceived, note the temperature. 3. Having a quantity of soluble glass which I wish to make into a cement, will glue, gelatine, or white shellac thicken the same? How should they be first treated? A. Use it alone or mix with hydraulic cement. 4. Is there a yellow soft solder? A. None that we know of except mercurial solders. 5. In making a thin emulsion of wax and spermaceti, what is best to use? A. Thinning with turpentine may answer; the solution may be emulsified with gum tragacanth and water.

(493) P. J. W. asks: 1. If there is any substance that he can mix with plaster of Paris so that it will adhere to stone and china ware, without cracking when it dries. A. Mix the plaster of Paris with strong solution of alum. 2. How plaster letters are put on pasteboard boxes? A. Probably some composition of glue and plaster would answer. You will find other mixtures among our queries.

(494) D. J. W. writes: Will you please inform me, through the columns of the SCIENTIFIC AMERICAN, how to test a steam boiler with a force pump and water? How many pounds pressure should a boiler stand, tested in this manner, to be pronounced safe? What kind of gauge should be used, and will an ordinary steam gauge answer? Does it make any difference about the size of boiler in regard to steam pressure, that is, will a small steam boiler with 50 lb. pressure be under any greater strain than a larger one with the same pressure? If a boiler burst while being tested with water, will the result be the same as if bursted by steam? Explain the difference fully. Will a 4½ or 5 H. P. engine have power enough to run a small pony wood planer? The planer has three knives about 24 inches long. If this engine is not large enough, what size cylinder will be? A. Steam boilers should be tested cold or nearly cold to 50 per cent more pressure than the steam pressure intended to be carried. Attach the testing pump connection to the feed pipe, if possible between the feed valve and the check valve. The pressure gauge attached to the boiler will serve for testing if no other can be had. The gauge dial should read to more than 50 per cent addition to the required pressure to be carried. Close the steam valve and other outlets, pump the boiler full of water, allowing the air to escape through the safety valve. Then set the safety valve weight to the required test pressure by its figures, or a little more if the figures on the lever do not coincide with the test pressure. Then pump up the pressure until the required amount is reached by the gauge, and if the safety valve is set at just the required pressure, see if it agrees with the gauge reading. If the safety valve is set at the next notch higher than the required pressure, pump the pressure up until a comparison can be made. Then examine every part of the boiler for leaks or apparent weakness, particularly around stays, tubes, and seams that may be exposed to rust. Then draw off excess of water. The pressure in a boiler increases the strain upon the shell in proportion to the increase in size. Boilers, as generally made, are good for 50 lb. steam pressure up to five feet in dia-

meter. For higher pressure an extra thickness of iron or steel is used, and the horizontal seams double riveted. The failure of a boiler under test pressure when full of water is harmless to surroundings, as there is no magazine of expanding energy to increase the explosive force beyond the instant of rupture, from the fact that cold water is a solid or non-compressible body, totally different from hot water at the temperature due to the pressure, which is ready to burst into a thousand volumes at the moment of rupture.

(495) W. A. asks: 1. What animals are the hides taken from of which belt lacing is made? A. Belt lacing is made principally from Calcutta hides, which are small and thin. Also made from hides of young cattle of the U. S. or South America. 2. Is mesmerism an accepted science? A. Mesmerism is not an accepted science. 3. What material can be used to clean windows of rolling mills that are coated with smoke and gas? We have tried turpentine, naphtha, coal oil, soft soap, etc. A. Try a strong solution of caustic soda to clean the glass, and polish with chalk. 4. I put some sleigh bells in a cleaning cylinder with some dog chains, putting in an unusual amount of leather scraps, almost filling the cylinder, but upon taking them out, the whole thirty were broken. Please tell me the cause. A. Sleigh bells are almost as brittle as glass, and often crack in ordinary use. They break in the tumbler by striking the iron shell as the mass rolls over. 5. The windows in my shop have 10 in. by 13 in. glass in them; there is a part of a particular pane that casts a perfect shadow; we can see through it as well as any other. Can you explain this result? A. By close examination the window glass will be found to have an uneven thickness, which influences the parallelism of the light rays, so as to concentrate the light in some parts and leaving other parts dark, on the principle of a lens.

(496) G. M. writes: 1. Would there be any demand for a loud-speaking telephone, one that could be heard in a large room as loud as a person would speak in a natural tone of voice? A. A practical telephone of this kind would be valuable. 2. Has any such telephone ever been devised? A. Loud-speaking telephones have been made, but they are not as loud as the human voice in ordinary conversation. 3. Why is it that some telephones will reproduce musical tones better than ordinary speaking tones? There must be some reason for it? A. Speaking tones are far more complex and irregular than musical notes, and are more difficultly reproduced. 4. If the theory of conservation of force is correct, and also that electricity is a mode of motion, how do scientists harmonize the two theories as exemplified in the permanent magnet, for they argue that magnetism is caused by electric currents, but to produce an electric current, there must first be motion or energy; but after once magnetized in a piece of steel, we have motion forever, or perpetual motion; but they say there is no such thing as perpetual motion. A. The theory of the conservation of force has long been abandoned as untenable, and in its place the doctrine of the conservation of energy has been formulated. In the permanent magnet, we have a perpetual or long-existing center of force, but not of energy. A magnet cannot drive a machine; if it could, then perpetual motion might be possible. But this never has and never will be done.

(497) C. E. S. writes: 1. I have a lot of electric light carbons; some of them are lighter and more brittle than others, and some are of higher resistance. Will one be as efficient as another for use in batteries, or which would be best? A. Other things being equal, the harder and better conducting the carbons are, the better the results will be in their use in batteries. 2. Why is it that I cannot make a perfect casting in a plaster of Paris mould, using brass type metal or lead? Perfect vent holes and moulds allowed it to dry perfectly before use. A. Plaster of Paris "sets" by combining with and keeping water. This it evolves as steam when heated. This interferes with its use as a material for moulds. It should answer for fusible metals, but will hardly do for brass, etc. See SUPPLEMENT, No. 17, for how to mould in plaster of Paris.

(498) S. H. writes: 1. Is there any cheap material to put into spirits of turpentine so as to give it a pleasant smell? Am not particular to the kind of smell, only I do not wish it to smell of turpentine at all, or at least very little. A lot of people, when they are having their houses painted inside, complain of the smell of turpentine. I thought there might be something put into it so as to give it a perfume. A. We can recommend no efficient treatment. 2. Can you recommend anything to make benzine perfectly odorless, say by the addition of any other liquid? A. Benzine is purified by treatment with bichromate of potash and sulphuric acid.

(499) B. B. B. asks: 1. Is fine clay dust (made in mining coal) explosive? A. Not unless it contains organic matter. Coal dust is the agent in producing mine explosions—not clay dust. 2. If so, what per cent of dust in the air is necessary to make it explosive? A. The exact percentage of coal dust is not known. It often acts to aggravate gas explosions rather than as a primary cause. 3. Is there any mechanical device to ascertain the per cent of dust contained in the air in mines? A. Collect a bottle full of air and let the dust settle. By knowing the volume of the bottle and weight of dust, you have the necessary data.

(500) G. H. R. L. writes: 1. Would a mechanical arrangement that, being once started, and would continue to move until it wore out, have any claim to perpetual motion? A. Not necessarily. 2. Is there any such arrangement? 3. Please describe, and who was inventor? A. We know of none. 4. Please explain best way to cure pork in our hot climate in summer time. Would it be advisable to cut it into small chunks? A. Use strong brine and keep the barrels covered. We can give no special instructions.

(501) H. A. B., Ithaca, writes: Will you kindly inform me on the inclosed question in optics, which I cannot solve satisfactorily from anything that I have at hand? A spherical lens will not give a perfect focus, but requires correction for spherical aberration, and also for chromatic aberration. A perfect parabolic lens, of any good glass, will give a perfect focus. Now, will such a lens require correction for chromatic aberration, and if so, why? A. The form or curve of a lens controls only the direction of monochromatic light to a common focus, so that a parabolic lens will bring any of the colored rays composing white light, as blue, red, yellow, etc., to a perfect focus; but as white light is composed of a number of colors, all having different refrangibilities, the glass acts upon the different constituents of light according to their wave lengths, and so separates the different colors into as many different images focalized along the optical center at distances due to the refractive index of each color. These superimposed images, so close together, produce to the eye a common confused image, as observed in the image of all single lenses. To correct this, the discovery of the different dispersive powers of various kinds of glass enabled a correction to be made, as in the achromatic object glass. See Glazebrook on Optics, which we can mail for $2.25. Also, see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 581, 582, 583, On Astronomical Telescopes and their Object Glasses.

(502) R. E. G. — Study and practice must be combined to make you an electrical engineer. If a college course cannot be taken, a position with an electric company should be secured. For books we recommend and can supply you with Thompson's Dynamo-Electric Machinery, $5; Thompson's Elementary Electricity and Magnetism, $1.25; Electricity in the Service of Man, by Wormell, $6; Practical Electricity, by Ayrton, $2.50; Atkinson's Electric Lighting, $1.50.

(503) C. A. B.—We recommend Locomotive Engine Running and Management, by Sinclair, $2. Also Roper's Hand Book of the Locomotive, $2.50. These will give you full information on the subject you desire.

(504) W. E. P. asks for a recipe by which mercury is made adhesive to glass. A. If a perfectly clean surface of melted alloy is brought into contact with perfectly clean glass, it will generally adhere thereto on solidifying. Mercury is poured upon tinfoil, and alloying with the tin forms an amalgam or alloy of tin and mercury. Perfectly clean glass is caused to slide over the amalgam with its forward edge below the surface. The amalgam, if not too liquid, adheres. Consult any encyclopedia, under looking-glass, to see the process described in more detail. Pure mercury will not adhere to any extent, because it is liquid.

(505) J. C. C. writes: Is there a cement that will adhere to metal, harden quickly, and stand a heat of 240° F. without softening? A. Use fusible solder; we know of no really reliable cement except white lead and linseed oil, or silicate of soda compositions. Good white lead ground in oil might answer.

Enquiries to be Answered.

The following enquiries have been sent in by some of our subscribers, and doubtless others of our readers will take pleasure in answering them. The *number* of the enquiry should head the reply.

(506) T. H. S. asks: Can any of your readers inform me how I can remove from an old wooden tavern sign a coat of paint put on it say fifty years ago, so as to leave the original picture painted on it over 100 years ago intact?

(507) C. H. asks: Through what cheap process (preferably a solution) may sheet tin be subjected to give it the appearance of being a composition of metals, such as zinc, brass or copper, and iron, so that the chemical used will have no detrimental effect on the tin?

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the numbers therein given:

(41) To Consume Stumps by Fire.—Crude petroleum, with a little saltpeter added, will render stumps combustible. The petroleum costs about two cents a gallon, the proportion of saltpeter I can't now give. Test or judgment must settle it. Bore a ring of inch holes equidistant between the bark and the center of stump to within a few inches of the bottom, fill the holes and keep them filled up as fast as it is absorbed by the wood. Dig the soil from around the stump some distance down. A temporary cover should be put over the stump to keep off the rain. Six weeks of dry weather will suffice.—T. H.

(191) F. A. L. S. wishes to know how to Restore Oil Paintings that are Cracked.—See paper on deterioration and restoration of oil paintings by R. Liebreich, M.R.S., in SUPPLEMENT, Nos. 149 and 151.

(203) A. T. D.—To Prevent Double Windows from Condensing Moisture and Frost.—In Russia, where all dwelling houses are provided with double windows, the sweating of the glass panes is successfully prevented through the use of a small quantity of sulphuric acid placed in a flat pan or cup between the two windows.—A. TENNER.

(253) M. S.—Resin for Electrophorus.—Make the die of electrophorus of equal parts resin, shellac, and Venice turpentine, and there will be no trouble in electrifying it. The turpentine is not necessary, but will prevent cracking.

(318) E. E. P.—Plastic Composition used for Wall Decorating.—Boil 1 lb. glue in gallon of water, add 2 lb. whiting; 2 lb. plaster Paris; 1 lb. white lead (such as comes in kegs mixed in oil). If above is too thin, add more whiting; if too thick, more water. The more white lead you use the slower it dries. House paint can be added to color, or same can be painted after it has set. Then varnished, gilded, or otherwise ornamented. Use an old whisk broom to apply. Designs can be impressed with sharp stick or finger. The above mixture ought to dry in twenty-four hours.

(329) D. T. M.—If the hardness of the water is due to bicarbonate of lime, add sufficient lime water to convert the bicarbonate into the very sparingly soluble carbonate. This is the Clark process, for a description of which see SUPPLEMENT, No. 270. For softening magnesia-hard water, see SUPPLEMENT, No. 187.

(363) G. W.—Area of Smoke Stacks.—The formula for chimneys for boilers is

$$\text{area} = \frac{\text{H. P.}}{1{\cdot}45 \times \sqrt{h'}}$$

in square feet; h=height. A common practice, for iron smoke stacks for medium sized boilers, is to allow 25 square inches of chimney area for each square foot of grate surface. See Nystrom's Mechanics for a valuable table of heights, areas, and horse power of chimneys, $3.50, which we can mail. E. D. L. sends rule: Multiply the h. p. by 112 and divide the product by the square root of the height of chimney for the area in square inches.

(365) S. S. S.—Bass-relief Signs.—Use papier mache alone or mixed with a small quantity of plaster of Paris. Wood pulp may also be used with the plaster. The plaster mache must be used quickly after mixing. It sets quickly and holds the relief cast in shape, and can be cast much faster than the clear papier mache.

(366) G. T.—Domes on Boilers.—From practical experience with steam boilers, I find that a boiler with a dome has a big advantage over one that has none, providing the boilers are of the same style, from the following reasons: The dome serves to carry steam at such an elevation above water line that a much drier steam is obtained, also prevents, to a great extent, the jerking over of water in case of either priming or foaming. There are boilers, however, so constructed, that it is not necessary to have a dome on them.—A. C. D.—

(367) I. P. W.—Street Railway Cable.—The pulling strain on the cable will be about 1,600 pounds, to which should be added the additional friction of grips, in the grooves, for curves and extra roughness of track. This indicates only about 43 horse power on the cable, but the machinery and engine for operating the cable will absorb as much more power, or say 90 horse for a clear straight track under favorable conditions. The possibilities may carry the power to three times the above cable strain.

☞ Books or other publications referred to above can, in most cases, be promptly obtained through the SCIENTIFIC AMERICAN office, Munn & Co., 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

February 26, 1889,

AND EACH BEARING THAT DATE.

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

Fire escape, J. W. Weaver 398,479
Fire extinguisher, J. M. Miller 398,643
Flanging machine, W. Thom 398,674
Flanging sheet metal cylinders, machine for, W. Thom 398,673
Flour chest, G. Kirchgraber 398,736
Flue cleaner, J. U. Wiler 398,483
Fog horn, automatic, A. F. Baatz 398,367
Folding chair, J. F. Bittle 398,693
Fountain. See Drinking fountain.
Frame. See Bag frame. Piano action frame. Traveling bag frame.
Fruit box, J. G. Lettelier 398,739
Fruit drier, H. A. Crandell 398,584
Fruit drier, G. Stringer 398,469
Fuel, artificial, L. Wacks 398,810
Fuel burner, H. H. Hull 398,729
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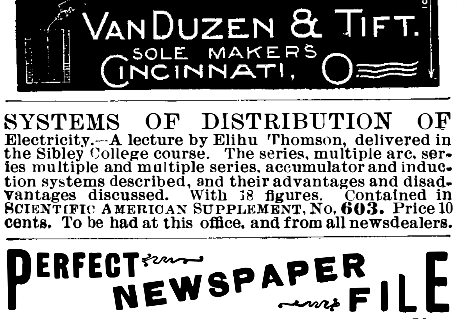

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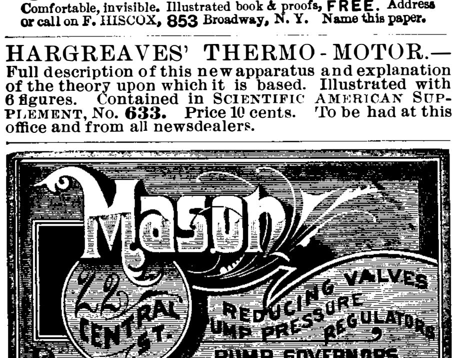

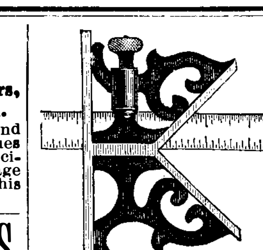

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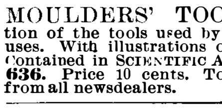

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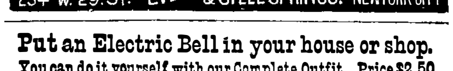

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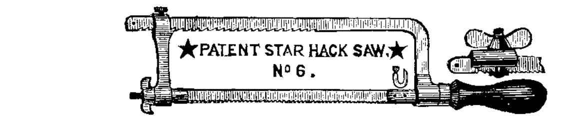

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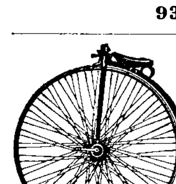

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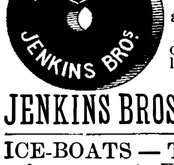

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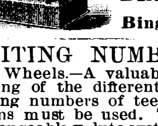

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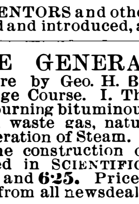

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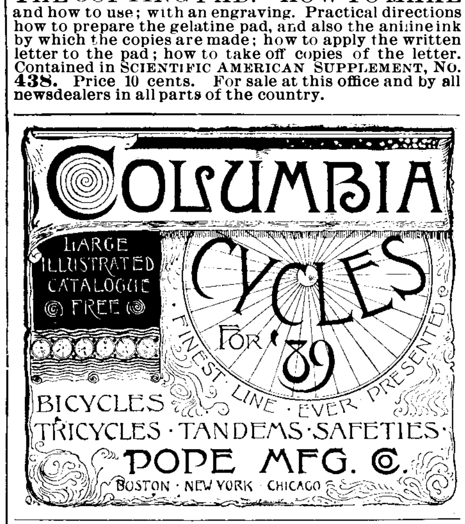

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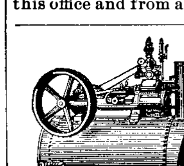

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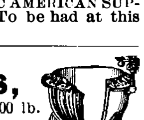

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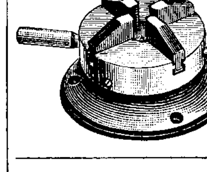

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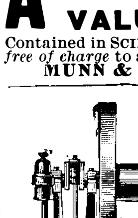

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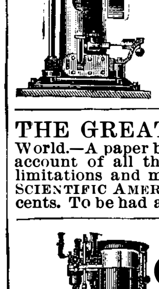

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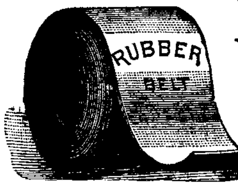

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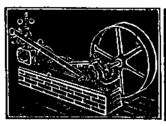

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