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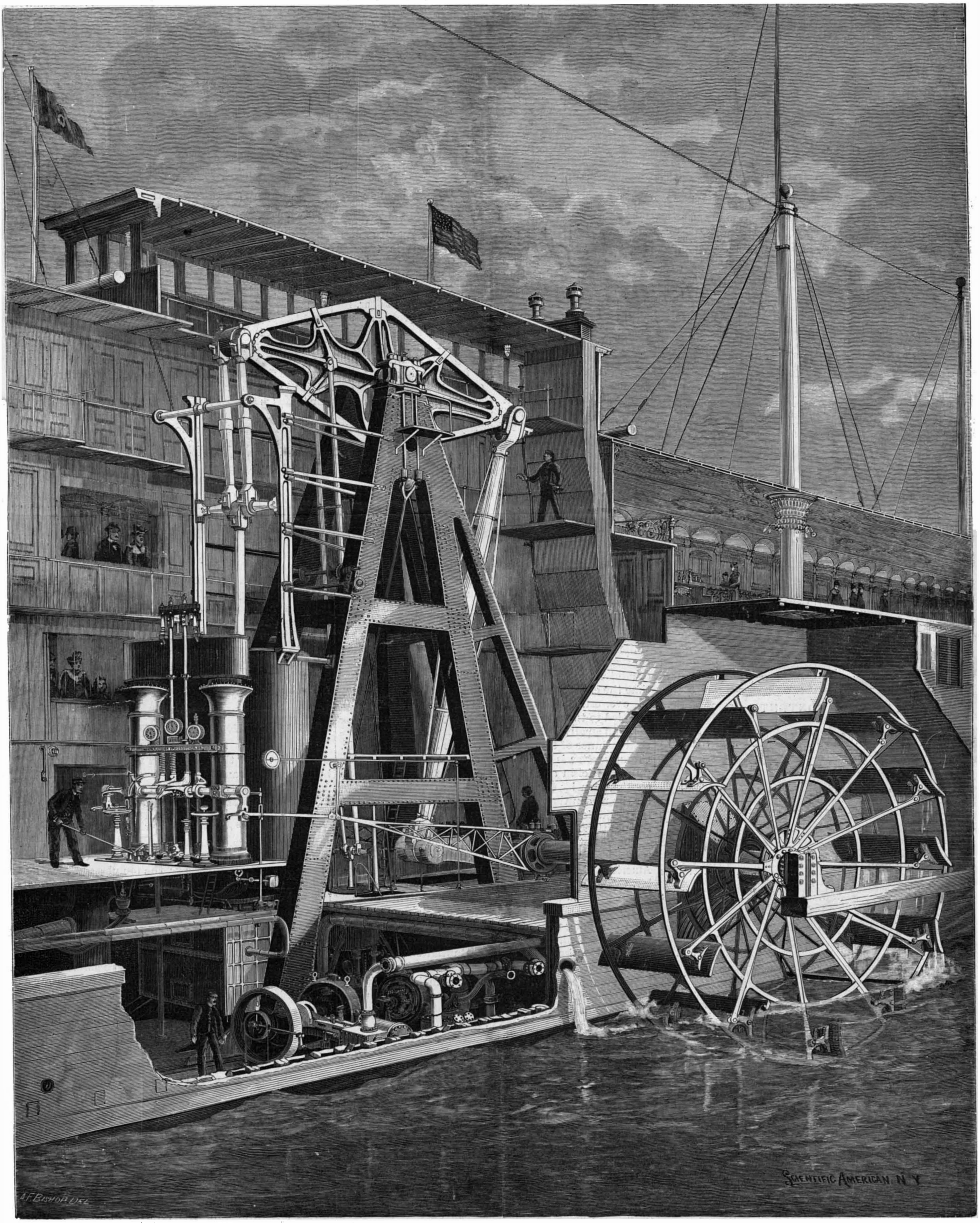

GENERAL VIEW OF THE SIMPLE CONDENSING BEAM ENGINE OF THE STEAMER ADIRONDACK.

Diameter of cylinder, 81 inches; stroke, 12 feet; boiler pressure, 55 pounds; horse power, 4,000.—[See page 456.]

Scientific American.

ESTABLISHED 1845

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NEW YORK, SATURDAY, DECEMBER 26, 1896.

Contents.

(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 1095.

For the Week Ending December 26, 1896.

Price 10 cents. For sale by all newsdealers.

SECRETARY HERBERT'S REPORT ON THE TEXAS.

The official statement of the Secretary of the Navy on the recent sinking of the Texas at the Brooklyn navy yard will go far to re-establish the confidence of the American public in this vessel. Mr. Herbert states that in giving out the action of the department on the finding of the recent court of inquiry he has concluded to depart from his usual custom and make a general statement about this ship. We are informed that the accident was due to the fact that a part of an injection pipe had been taken out for repairs, and that the accident "could not have happened at sea." He reviews the past history of the ship and states that as the result of a competition of naval architects a board of eminent naval officers awarded the prize to a prominent English designer, Mr. John. This was done in accordance with the policy by which "we were availing ourselves of the experience of foreign nations." Since her launch various defects have developed themselves, and among other changes she was sent to the navy yard at Norfolk to have her bottom stiffened. It is now believed that all defects have been remedied except those relating to her turrets and the system of water-tight compartments, which latter were developed by the recent flooding of the vessel, as shown by the finding of the court of inquiry. Mr. Herbert points out that while it would be desirable that all our ships should be turned out in perfect condition, this has never been accomplished in our own or any other navy. It is believed we have made fewer and less costly mistakes than most other nations in the building of a modern navy, and yet the Castine and Machias had to be cut in two and lengthened; and three other ships, the Detroit, the Montgomery, and the Marblehead, required "far more fundamental changes than have ever been found necessary in the Texas." Nevertheless, the latter for some reason or other, has been the subject of an unusual amount of harsh criticism.

We are glad to learn that such officers as Capt. Glass, her commander, and Capt. R. D. Evans, commanding the Indiana, unite in declaring that the Texas is "the stiffest, most easily managed, and entirely seaworthy ship in the service." Capt. Evans states that in the hurricane of October 12 she showed herself to be the most seaworthy ship in the fleet, rolling considerably less than the Indiana and the Maine, which were just ahead and just astern of her. The captain also states that she was a perfect gun platform, and in this respect, and in respect of her seaworthy qualities, was superior to such fine ships as the New York, the Columbia, and the Raleigh.

The Secretary then goes on to quote from a letter from Charles H. Cramp, in which the writer says: "I have always defended her (the Texas) to an extent that has made me obnoxious to many officers in the navy, who were bitterly opposed to the adoption of Mr. John's scheme." After examining the plans and specification, Mr. Cramp stated that they were "good, symmetrical and practicable;" that they were by odds the best submitted in that competition; and that while the scantlings were light, "as a whole her hull construction involved the best mechanical distribution of minimum weight" that he had ever seen. At that time the era of steel was new and there was a tendency to over-estimate the strength of the new material. This led to the placing of very heavy armor and armament on small displacements, and the Texas is a practical instance of this tendency. The latter part of Mr. Cramp's letter is devoted to strenuously deprecating public criticism and discussion of the defects of naval construction by the press, which he considers unwise, for the reason that such criticisms are used abroad to the prejudice of our industries when they enter into competition for foreign work.

The Secretary calls especial attention to Mr. Cramp's remarks about the effect of criticism by the press of American ships and armor plate. He says, "I submit Mr. Cramp's letter for the purpose of pointing out to some of our newspaper friends the unintentional injuries to American interests that are liable to result from enlarging upon minor mistakes that may have been committed, even though at other times full credit be given for the great and substantial successes that have been attained."

We do not agree with Mr. Cramp in his opinion of the value and effect of newspaper comments upon naval work. Such criticisms are not confined to the American press, as readers of any of the English technical journals can testify. There is never a new design for British warships published but what it calls forth a storm of hostile criticism, and the same thing obtains in France. It is the privilege of the public which pays for the ships to have its say about them, and while there is a great deal of matter written which is arrant nonsense, there is much other criticism which is intelligent and to the point and healthy in its general effect. If, as Mr. Cramp says, such criticism has occasionally robbed this country of contracts for building foreign warships, it is to be regretted; but we think that such an occasional loss is not a sufficient reason for asking the public to suspend its right to pass judgment upon or discuss the merits and defects of its new navy. It has been a difficult task to awaken the people at large to the necessity of a navy at all, and there has been no agent so active in this awakening as the daily and weekly press.

On the whole, the statement of Secretary Herbert is reassuring, at least to that part of the general public which has been disturbed by the exaggerated statements regarding this ship which have been put fort from time to time by the ultra sensational element of the daily press. We regret, however, that more explicit information has not been given regarding the flooding of the Texas and the causes which led up to it, and more particularly, as it concerns the failure of the so-called watertight bulkheads. In our remarks on this accident in a previous issue, we took it for granted that the watertight doors must have been open. It appears, however, that they were closed, and, therefore, for the purpose of fulfilling their function they seem to have been utterly worthless. This, we consider, is by far the most serious aspect of the case, and we fail to find any reassuring statement or suggestion in the present official utterance. We are told that the accident could not have happened at sea. Why not? Is there any peculiar and unknown quality in the metal of a valve yoke which causes it to hold together when a ship is in thirty fathoms of water and only break when she is in thirty feet? If it is safe to remove a part of an injection pipe for repairs when a ship is afloat, it is just as safe to do it in sixty feet as in thirty feet of water; and it is due to the lucky fact that the Texas lay where she did at the time of the accident that an appalling accident did not take place and she is not to-day at the bottom of the river.

Even if it is allowed that the removal of a section of the injection pipe is a proper thing to do outside of a dry dock, and that valve yokes are not likely to break at sea or when the ship is in deep water, how came it that the engine room bulkhead did not keep the ship afloat? It is suggested that possibly valves were open in the bulkhead; but surely such a court of inquiry was capable of ascertaining to a certainty whether they were or not. If they were, the failure is explained; if they were not, the compartment system of the Texas is a miserable failure.

We must confess to considerable disappointment that explicit information is not given upon this very important point, and that the direct responsibility for the disaster is not distinctly placed. It is evident to the veriest novice in naval matters that by taking the most elementary precautions this accident would have been avoided. All the elaborate and costly appliances of a modern warship are worth about their weight as old junk if they fall into the hands of individuals who fail to exercise proper forethought and discretion in handling them.

We cannot but feel that in its report, as outlined by the Secretary of the Navy, the court of inquiry has passed very lightly over an occurrence which calls for a detailed explanation, and that in deciding that no one was responsible for the mishap, it has shown a leniency that does more credit to its heart than to its judgment.

That in time of peace a battleship should founder at her wharf, with watch on board and fire in her boilers, is, in our judgment, absolutely inexcusable.

THE PREVENTION OF RUST IN IRON AND STEEL STRUCTURES.

The advent of the age of iron and steel in the arts of building and manufacture brought in an element of decay which scarcely existed in the age of stone. For while we are able to build on a grander scale, and combine the new material in daring forms which the primitive ages merely dreamed of and never attempted, we cannot look upon our finished works with the same assurance of their permanence that filled the builders of the Egyptian pyramids or the temples of Greece and Rome. Often when the stone was hewn from the quarry and exposed in a building to the wear of the elements it hardened under the exposure. Nature was thus the friend of the architect, and dealt kindly with his work. The very winds and weather which colored it with the mellow tints and peculiar beauties of age gave it strength as lasting as that of the hills themselves.

But the iron and steel of modern construction are as perishable as they are strong. The action of the elements, which sometimes prolonged the endurance of an ancient structure, commences to destroy our modern works in iron and steel from the very first moment of contact. Unless some thorough system of protection be adopted, it is certain that the life of the skeleton steel buildings, for instance, which are multiplying so fast in our cities, will never be measured by centuries. The dangers of decay are serious indeed, even in the case of such ironwork as is open to inspection; for in certain climates the oxidation is so rapid that it takes a comparatively brief time to reduce the section of the metal, so that it is brought perilously near to the breaking point and far below the proper margin of safety. Notable instances of rapid decay may be found in some of the more neglected parts of the viaducts and bridges of this city, where, for the want of thorough and frequent painting the ironwork is being eaten away under the combined attack of the moisture and salt air of our climate.

But although structural ironwork is open to the attack of an alert and ever present enemy, it is well understood that so long as its parts are open to inspection and may be reached by the paint brush its life may be indefinitely prolonged. If they are carefully cleaned, and coated with good paint at the time of erection, subsequent inspection and repainting systematically carried out will render our iron and steel structures practically imperishable.

The introduction of the skeleton system of building, however, has brought with it new and comparatively untried problems. The methods of construction which are used to insure the integrity of the steel work are radically different; for whereas the bridge builder is careful to leave all the parts of his structure exposed, the builder of the "skyscraper" is just as careful to cover them up. This concealment is rendered necessary in the case of the columns that carry the outside walls by the demands of construction, and the interior columns and floor girders are inclosed in the endeavor to secure a fireproof construction. The nature of this covering varies but little. It usually consists of stone or common brick or some form of fire brick, and when the steel members are once sealed up from sight, the question of their actual condition as the years pass by is a matter for speculation, but never a matter of certainty.

It is true the columns and girders are treated to a coat of paint at the shops, and no doubt in many cases there is an attempt to do this work thoroughly and with a good quality of paint; but there are thousands of tons of material that go into the buildings with the work carelessly or cheaply done. And even where the steel has been honestly painted at the shops, the subsequent handling in transportation and in erection at the building does more or less damage to the paint, rubbing it off and exposing the metal. Nevertheless, there is no effort made to repair the damage, and the girder or column, as the case may be, is shut up within a porous and not always an airtight casing, in which the rusting of these exposed surfaces is free to go on unseen and unchecked.

It is unfortunate that we have very few facts to go upon in estimating the behavior of inclosed steel or iron work. This style of construction is so modern that there has not been sufficient lapse of time for any reliable data to be gathered; and such cases as have been quoted for or against the permanence of walled-in iron work are few in number and stand good only for the particular circumstances that surround them. If a column which had been built into an interior wall was found free from rust at the end of a certain number of years, it would be no proof that another column built into an outside wall and on the weather side of the building would be equally secure. And we must not argue that, because there was no oxidation of a structure in the dry air of the city of Denver, five or six thousands of feet above the sea, a similar structure in the moist atmosphere of a sea coast city would escape injury.

The painting which the steel work receives at the shops should, at least, be repeated when it has been erected in place, so that any spots where the paint has been chipped or rubbed off, exposing the metal, may be protected from the action of the air.

In its way, this question of the rusting of covered iron work is as important as that of fireproofing; but it is not likely that it will receive the same careful attention; for the reason that, while the latter question is one of ever present, vital importance, the former is slow in its action and affects a more or less remote posterity. And yet, if there are duties which we owe to posterity, surely this is one. If by a little reasonable care, and an expense only slightly greater than that which is at present incurred, the costly buildings of to-day may be saved from a possible ultimate collapse, the care should certainly be taken, and the expense incurred.

Blockade of the Underground Trolley Line on Lenox Avenue.

During the snow storm of Wednesday, December 16, the underground electric trolley line on Lenox Avenue was disabled for several hours. This is the first time that this line has succumbed to the weather, and as the underground trolley system may be said to be yet on its trial, the facts concerning this breakdown will be of interest. It seems that when the storm came on, only about one-half of the usual amount of power was available, for the reason that half of the generators at the power station are at present being rebuilt. According to the chief engineer's statement, this would have been sufficient to keep the cars running under ordinary circumstances; but the mechanical resistance of the snow and the slippery condition of the rails, preventing adhesion, proved too much for the motors. After the snow plows and sweepers had opened up the line, a sudden drop in the temperature caused a coating of ice to form on the conductors, and thus prevent full contact. The conductors consist of two wrought iron pipes, one on each side of the slot, which are carried on insulators attached to the ceiling of the conduit. The difficulty of ice forming on the wires is not unusual with the overhead trolley, but one would have thought that the protection of the closed conduit would have prevented such an accident. The difficulty was overcome by equipping the car with knifelike scrapers which cleared the conductors of ice just ahead of the contact shoes. By the time the cars were ready to run again after the scrapers had been attached, the conduit had filled up with snow and slush, and the tracks were so covered that it took several hours to get started. It is the intention of the company to equip every car with removable plows specially designed for keeping the conductors clear of ice. In some of the northern cities and in Canada, it has been a common thing during a storm of sleet to put a man on the top of the cars of an overhead trolley line, who carries a forked spear with which to scrape the ice off the wires. We are informed that this blockade will have no effect upon the determination of the company to equip the Fourth and Sixth Avenue lines with the underground trolley system.

Traps for Inventors.

In this nineteenth century the profession of patent solicitors is degenerating from the professional to the commercial. Inventors and patentees have their attention arrested by flaming announcements, with the object of catching unwary inventors and patentees. One class of these agents offer medals as certificates of value of inventions, and large lottery prizes, amounting to thousands of dollars, to inventors who place their applications for patents in their hands. However, before a medal or prize is awarded these inventors selected, in order to become acceptable competitors, they are compelled to pay into the hands of these agents certain fees. These competing inventors are told, or induced to believe, that a scientific and mechanical corps of experts in the employ of these agents make crucial examinations of their inventions, in the light of the prior state of the art, and the inventions of all others who are competing for a medal or the prizes, and in due time they respectively receive a communication from their agents, accompanied by a medal, certifying that they have been awarded the medal by a corps of experts, on the ground that the invention is determined to be the best of all others presented to them for patents. At some subsequent period it is announced that the money prize has been awarded to A, B, or C.

It would seem that intelligent men would not fall into such traps in this enlightened age; but, alas! they, like innocent lambs, are led to enter and made to suffer; or are dealt with in the same manner as are unsophisticated rural citizens who fall into the hands of "green goods" merchants.

For many years the story of the gold [gilded] medal awarded by a French scientific society to United States patentees has been well known, and yet victims are constantly being made. When the announcement is received from Paris that the gold [gilded] medal has been awarded to a United States patentee for his invention, after an examination by its savants, and it has been found to be the best of the kind patented, there is a demand for a considerable sum of money to pay the expenses of the transmission of the medal to this country. The expectation of receiving this sum of money is the secret of all the interest that this French association manifests in regard to United States patentees. A bald attempt to get money for a gilded medal, issued by a set of questionable persons, ought to be understood by intelligent patentees when they read the word "gilded" in small letters, inclosed in brackets, following the word "gold." Such medals, whether American or foreign issues, should not be accepted by inventors, or investors in inventions of others, as proof of merit. They are nothing more than sawdust sold by "green goods" men.

Recently an inventor applied to one of the United States medal awarding patent agents and received a medal, but no patent; and after he had expended about $175 as fees to this agent and to the Patent Office, he made a visit to Washington, D. C., and called on the chief of police in respect to his patent business, and finding that his money was wasted and beyond recovery, requested him to refer him to an honest, reliable and capable patent counselor and solicitor, and being given the name of a respectable house in Washington, he visited the same, and on entering the door he said, "I am referred by the chief of police to you, as the kind of patent solicitor I am seeking. I do not want a medal awarded me, for my medal has cost me $175, and no patent has been granted me. I want an honest, reliable attorney, who, when he takes my case, and I pay him my money, I can go home and feel satisfied that all will be done squarely, and I shall get a patent for my invention from the United States Patent Office, instead of a mere medal from my agent." The experience of this inventor ought to be a warning to others, and the course that he pursued should be followed by them.

Some years ago an advertisement appeared in the papers as follows:

"Wanted—An invention for sawing stone to a taper form; $5,000 reward offered for the best invention of the kind for this purpose."

In response to this announcement, made, no doubt, by some designing, hungry patent agent, in conspiracy with an outside accomplice, for the purpose of increasing his income, several hundred inventors sent models of stone sawing machines to the Patent Office for patents. Nearly every one of these models represented two saws set to form an acute angle, and as the saws descended cut the stone to a taper form. One agent filed so many applications in the United States Patent Office, all like one another, that the principal examiner of the Patent Office in charge of this class finally became disgusted with such proceedings on the part of this agent, and wrote a letter to each of the later applicants substantially in these words: "Your application for a patent on a machine for sawing stone to a taper form has been examined and rejected on application of A. B., C. D. and E. F., filed through the same agency that has your case in charge." This was a sockdolager to the agent, and an eyeopener to his clients.

Sequel to the stone saw prize: At the termination of the period set for awarding the $5,000 prize offered for the best stone sawing machine, these expectant inventors carried their models of stone sawing machines to a place designated in Vermont, and, alas! on exposing them to the supposed generous citizen who had advertised for the inventions, were told that none of the plans were as good as one which he had invented himself, and therefore the prize would not be forthcoming. Sad hearted and disappointed, they returned home with an experience which ought to last a lifetime. By this trap inventors were led to expend thousands of dollars for models, traveling expenses, and agency and government fees, with no profit to themselves, simply benefiting an unscrupulous patent agent and his accomplices. Inventors ought to look carefully before they bite at such bait.

Another trap set for patentees is the one that the Inventive Age, of Washington, D. C., has for many months been warning patentees against. This trap is the patent right selling agent, who sends to every patentee a letter, which letter says: "Your patent has been examined by our scientific board or corps of mechanical experts, and it has been pronounced to be worth $25,000, or $50,000, or $100,000, and we would like to have the agency for selling your patent." Furthermore, offers are made to take out foreign patents on already issued United States patents for one-half the usual fees, etc. It is only necessary to say that patents in many foreign countries for United States patented inventions, which have been published in the United States Patent Office Gazette fully enough to be understood by practical mechanics, are invalid, even if granted by such foreign government.—New Ideas, Phila.

Do Not Lose or Throw Away Your Papers.

By taking only a little trouble, when a paper first comes to hand, it may be kept in a way to form a permanent and most valuable addition to the reading matter with which all families and individuals should be supplied. We furnish for such purpose a neat and attractive binder, which will be sent by mail, prepaid, for $1.50, or $1.25 if sold over our counter. It has good, strong covers, on which the name SCIENTIFIC AMERICAN (or SUPPLEMENT) is stamped in gold, and fasteners by means of which the successive numbers may be placed and securely held in order as in a bound book. One binder may thus be made serviceable for several years, and when the successive volumes, as they are completed, are bound in permanent form, the subscriber ultimately finds himself, for a moderate cost, in possession of a most valuable addition to any library, embracing a wide variety of scientific and general information, and timely and original illustrations. Save your papers!

The Value of Good Roads.

Cultivating ten acres, eight miles from the station, I buy two tons of fertilizer for $70, says a correspondent of the Leesburg (Fla.) Commercial. This quantity makes eight loads for one horse, and six hours are required for a trip. The time of myself and horse is worth 60 cents per load. I make 500 crates of vegetables, which require seventy-one trips to get them to the station, at a cost of $42.60. On hard roads I could haul my $70 worth of fertilizer in four trips of four hours each, at a cost of $1.60. I could haul my 500 crates of vegetables in thirty-five trips of four hours each, at a cost of $14. On the sand roads one horse is required seventy-one days to ship my crop, which is a longer time than the shipping season; hence I am compelled to keep two horses during the year, or hire from my neighbors at a busy time. The cost of keeping the second horse may be safely estimated at $25. So much of my time is used in my trips to town that during three months of the year I am compelled to hire an extra hand, which costs me about $45. The foregoing items will suffice to show that bad roads cost on my ten acre crop $101.80, being a tax of over $10 per acre.

WHAT better Christmas present can a father give his son than one year's subscription to SCIENTIFIC AMERICAN?

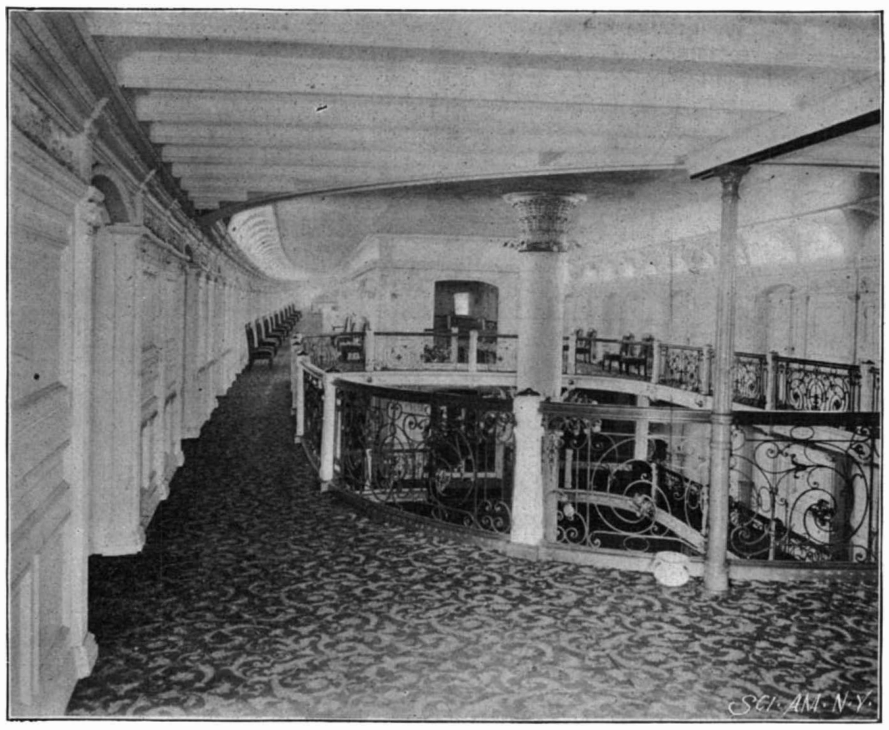
THE HUDSON RIVER STEAMER ADIRONDACK, OF THE PEOPLE'S LINE.

We present in this impression a series of views of the Adirondack, the latest addition to the famous fleet of Hudson River steamers that plies between this city and Albany. It was as far back as the year 1834 that the People's Line, which owns this handsome vessel, made a modest start in river transportation by launching the Westchester; and during the intervening sixty-two years the company has carried a very large share of the travelers that go during the summer months to Saratoga, Lake George, the Adirondacks, and the St. Lawrence regions. The rapidly increasing travel by this line during the last few years called for a further addition to the fleet, and it was resolved to build a boat which, in size, speed, and accommodation, should rival anything afloat on the river.

The keel of the Adirondack was laid at Greenpoint, New York, on June 8, 1895, and within five months the vessel was launched, the fitting out being completed in time for the summer season of 1896. The hull is built almost entirely of wood, and the beam engine, which is of the vertical pattern so common in river service, is of the simple surface condensing type. At first sight it may appear surprising that in this age of steel shipbuilding and quadruple expansion engines, so fine a vessel as this should be built of wood and provided with a single expansion low pressure engine. The Adirondack, however, was built to meet the special requirements of the Hudson River navigation, and her design is based upon the experience of steamboat men who have grown gray in this particular service. Wood was chosen for the hull because it gives a more flexible and stronger boat, stronger, that is to say, for the strains to which it is subject in pushing its way over the shoals of the upper river when the water is at a low stage. A wooden hull that is stiffened by a truss such as is seen in the general view of the boat will spring and give if it should touch in passing the river bars, whereas the plates of a steel hull would be broken or bent permanently out of shape.

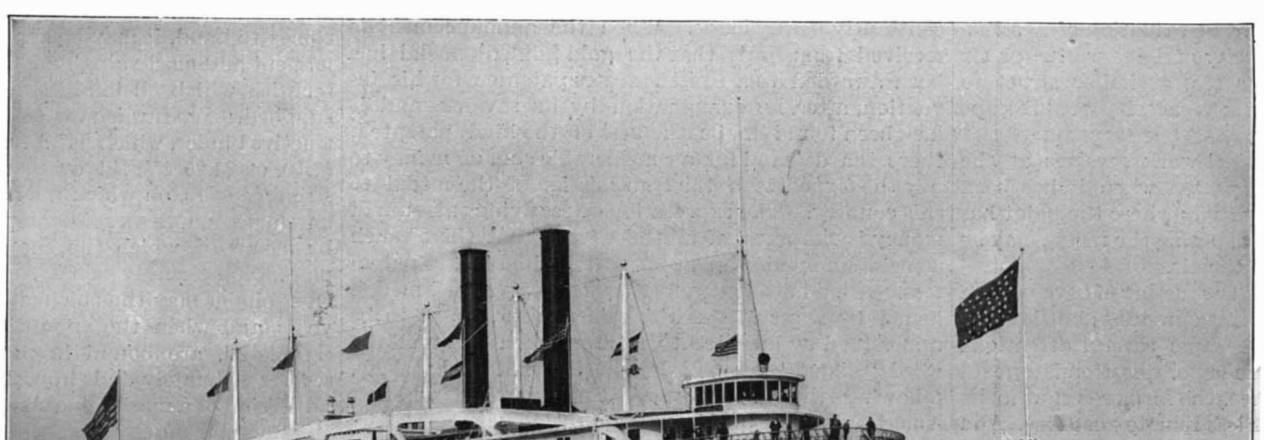
It may be mentioned here that the engine was built as a simple, in preference to a compound or triple expansion engine, because the company estimated that it would prove in the long run, for the particular class of work this boat has to do, a more economical design. While they were aware that, for continuous sea service, a multiple expansion engine is more economical, and will more than recover the extra first cost of its numerous and complicated parts, it was felt that the conditions of service for this boat were so entirely different that the same saving could not be realized. The Adirondack is only in service for a part of the year, and makes but one trip a day, of about ten hours' duration. It was estimated that the total value of the fuel saved during the comparatively brief hours of service would not equal the interest on the extra cost of building and running a compound or triple expansion engine.

The dimensions of the Adirondack are: Length over all, 412 feet; beam, 50 feet; width over guards, 90 feet; depth of hull, 13 feet; and draught, 8 feet. She is of 4,500 tons gross measurement and has a freight capacity of 1,000 tons. The oak keel is 12 inches wide by 16 inches deep. The frames, which are of oak, chestnut and red cedar, are 12 inches thick and are spaced 24 inches center to center. They vary in depth from 20 inches on the floor to 10 inches at the sides. There are 11 keelsons of yellow pine, measuring 12 inches by 20 inches, and they are bolted to the frames at each intersection by four bolts. The entire hull is strengthened by diagonal straps of ½ inch by 4 inch iron, which are riveted to the frames at each intersection. The hull is also stiffened by two deep suspension trusses or "hog frames," the top chord of which is 14 inches wide by 30 inches deep. There are three watertight bulkheads, which reach to the main deck.



THE GALLERY OF THE ADIRONDACK

In order to give our readers a clear conception of a typical river steamboat beam engine, we have prepared the detailed and very handsome engraving shown on our front page. The reader is supposed to be looking at the boat from a position a little off from the port bow, the side of the hull and superstructure and the housing of the paddle wheel being broken away so as to show the full height of the engine, which extends through four decks. The engine foundation consists of deep steel keelsons, which are securely bolted to the wood keelsons above mentioned. The A-shaped gallows frames are built up of steel plates, the legs, which are of box section, being strongly braced together with struts, which are also of plate steel and open box section.



THE HUDSON RIVER STEAMER ADIRONDACK OF THE PEOPLE'S LINE.

The walking beam consists of a strongly ribbed cast iron web, belted with a heavy wrought iron strap; the whole being firmly strapped and keyed together. The cylinder is 81 inches in diameter by 12 feet stroke. The two large vertical pipes seen in front of the cylinder are known as the side pipes; the one on the starboard side being the steam pipe and the other the exhaust. Each of these pipes carries a separate rocking shaft which is operated by its own eccentric. The motion of each rocking shaft is communicated to the two vertical lifting rods which operate the valves by means of two cams called "wipers." The eccentric rods are formed with hooks at their outer ends, which engage a pin in the arms of the rocking shafts. They are thrown out of gear by means of the slotted vertical rods through which the eccentric rods work, one of which will be seen in the engraving. These vertical rods are known as strippers, and they are operated by the levers which will be noticed attached to the rocking shaft on the steam pipe. When it is desired to start or reverse the engine, the eccentrics are thrown out of gear, and the valves are worked by a steam starting and reversing engine, which is controlled by the vertical lever seen near the steam pipe. If it is desired, the valves can be operated by the starting bar shown in the engraving.

The handwheel on the small vertical standard in front of the exhaust pipe opens the steam valve for the starting engine, and the wheels which are seen on the other two standards are for operating the injection valve and for turning the surface condenser into a jet condenser, if at any time it should be desired to do so. The surface condenser is located in front of the steam cylinder and below the main deck. Behind the steam cylinder and also below the main deck is the air pump, which is operated by connecting rods from the walking beam. The gear shown attached to the front face of the gallows frame, above the cylinder, is a hand winch, for lifting the cylinder head.

The paddle wheels are of what is known as the vertical or feathering type, in which the buckets are made to enter and leave the water in a nearly perpendicular position. The old type, with fixed radial buckets, is extravagant and uncomfortable; extravagant because it wastes power in forcing water downward when the buckets strike, and lifting it when they leave the water, and uncomfortable because they set up a violent vibration throughout the whole vessel. The feathering paddle wheel is smoother and more efficient in its action. Its construction is as follows: Bolted to heavy timbers just above the guards is a large pin carrying a loose flanged ring, to which are pivotally attached a set of connecting rods At their outer ends these rods are pivotally connected to rocking arms fastened to the back of the buckets, the buckets themselves being pivotally attached to the rigid spokes of the paddle wheel. The wheel itself is carried, as usual, on an extension of the crankshaft; but there is no outboard bearing on the guards, the whole weight being carried on a massive pillow block, which is securely bolted to the framing of the hull. The above mentioned pin and loose ring are placed eccentrically to the crankshaft, and the ring is rotated in its proper relation to the paddle wheel by attaching one of the connecting rods rigidly to it. The eccentricity of the ring is so adjusted that the buckets shall always enter and leave the water in a perpendicular position, thus securing a true feathering action. The wheels are 30 feet diameter and carry 12 curved steel buckets, each 45 inches wide by 12 feet 8 inches long. The dip is about 5½ feet. The average speed of revolution is about 26 per minute.

There are a donkey boiler and two "Worthington Duplex" fire and wrecking pumps, and a large "Worthington Admiralty" bilge pump between decks, their combined capacity being 1,000 gallons per minute. The electric light plant, consisting of three Armington & Simms engines, has a capacity of 2,400 lights. Two of these engines are shown below the main deck. They are of the direct connected type. The pilot house carries a search light which will enable objects to be distinguished at a distance of two miles.

Steam is supplied by four steel boilers of the lobster return flue type, each 11 feet wide, 9 feet 3 inch diameter of shell and 33 feet long, with steam chimneys 87 inch diameter and 10 feet 6 inches high. Forced draught is supplied by two large "Dimpfel" blowers, driven by independent engines. The steam pressure is 55 pounds to the square inch, and the total horse power 4,000. The engines, boiler and machinery were constructed by the W. & A. Fletcher Company, of Hoboken, N. J.

The Adirondack was modeled and designed by Mr. John Englis, vice-president of the company, and embodies the results of long years of experience as to the requirements of river navigation. Externally, as the excellent photograph taken specially for the SCIENTIFIC AMERICAN will show, she is an extremely handsome vessel, with all the characteristic marks of a Hudson River boat, and more than the ordinary beauty in her lines. By careful saving of weight in the design, it has been possible to give her an extra deck over the number carried by other ships of her size and horse power on the river. There are five in all: the main, saloon, gallery, upper gallery and dome decks, and all this on a draught of 8 feet of water. There are 350 staterooms, including 24 parlor rooms and 4 suites of parlors. There are also 286 berths in the cabins and 120 berths for the crew. Each stateroom has an iron or brass bedstead, and has a window on the outside of the vessel. The dining room on the after part of the main deck is surrounded by large windows, which give an uninterrupted view of the river on both sides. Two private dining rooms at the extreme after part of the vessel open into the main dining room. All these rooms are finished in white mahogany, with decorated panels in the ceiling,

STAIRWAY FROM SALOON TO GALLERY.

and at each intersection of the panels is an electric light drop covered by a round cut glass globe. There are 200 such lights in the dining room alone.

From the quarter deck, which is finished in white mahogany, a grand staircase leads to the main saloon, which is unusually handsome in its appointments and decoration, the predominating style of the latter being Empire, white, green and gold. A rich effect is secured by the beautiful design and workmanship of the wrought iron and mahogany hand rails around the galleries; and it is noticeable that the dome ceiling is free from any break by lighting appliances, the lights being concealed at the base of the cove.

On the upper tier, in the extreme after part of the upper gallery, is situated the café and smoking room, which is arranged with windows on three sides, so as to provide a clear view of the beauties of the Hudson River.

In addition to the ample water supply in case of fire, the thermostat is used in every stateroom and in all exposed parts of the ship, so that any outbreak of fire would be quickly located.

The Adirondack has never as yet been run at her maximum power; but she has run with a full load of freight and passengers from alongside her dock at New York to Albany, a distance of about 144 miles, in 7 hours and 55 minutes. The fastest speed, 20½ miles an hour, was made between New York and Hudson, the speed being considerably reduced in the upper river by shoal water.

ARMOR FOR FORTIFICATIONS.

Between projectiles and armor there has been a constant struggle for superiority, for while, on the one hand, every effort has been made to bring the projectile to such a state of perfection that it will destroy even the strongest fortification, the resisting power of armor has, on the other hand, been just as steadily increased. It has been extremely difficult to find armor suitable for naval purposes, because, although the thickness of the armor was an important consideration, it had to be limited on account of the danger of overloading the vessel to which the armor was applied. At first, and until 1875, rolled iron was used for armor and then

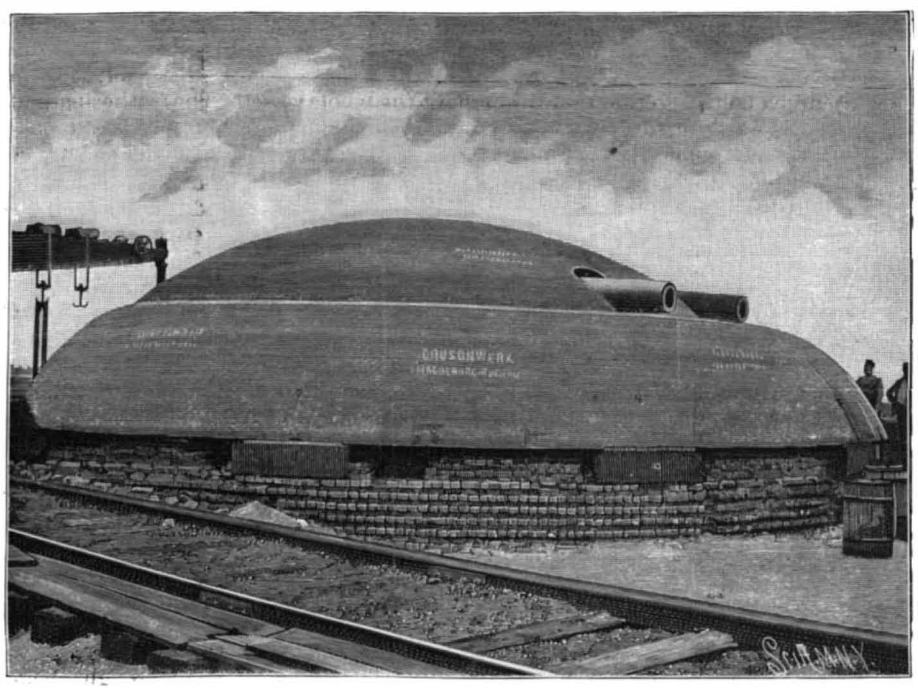


Fig. 1.—CHILLED IRON ARMOR TURRET FOR TWO 24 CM. GUNS—EXTERIOR VIEW.

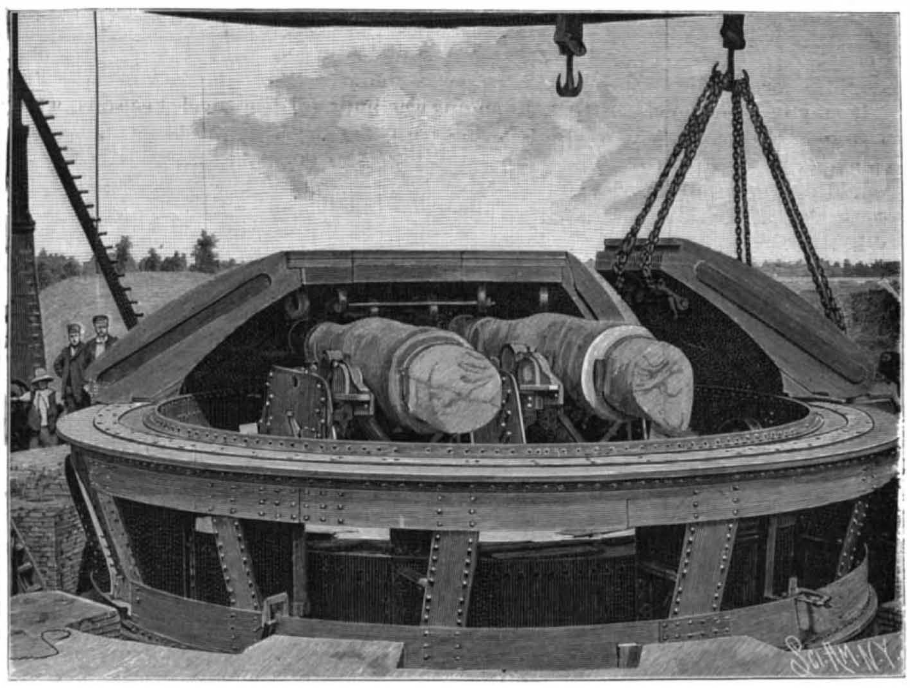


Fig. 2.—CHILLED IRON ARMOR TURRET FOR TWO 24 CM. GUNS IN COURSE OF CONSTRUCTION.

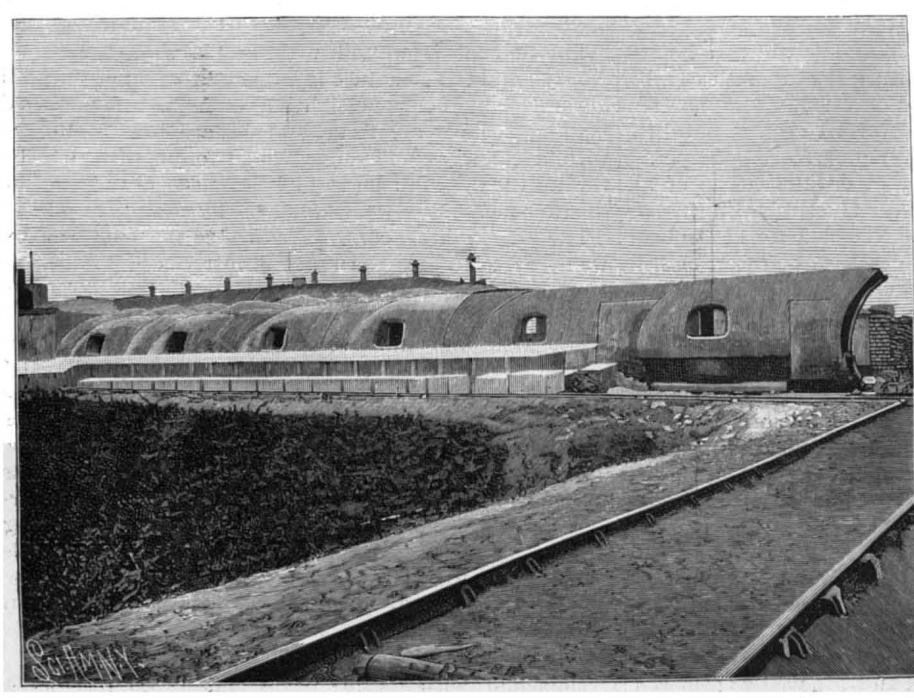


Fig. 3.—EXTERIOR VIEW OF A CHILLED IRON ARMOR BATTERY

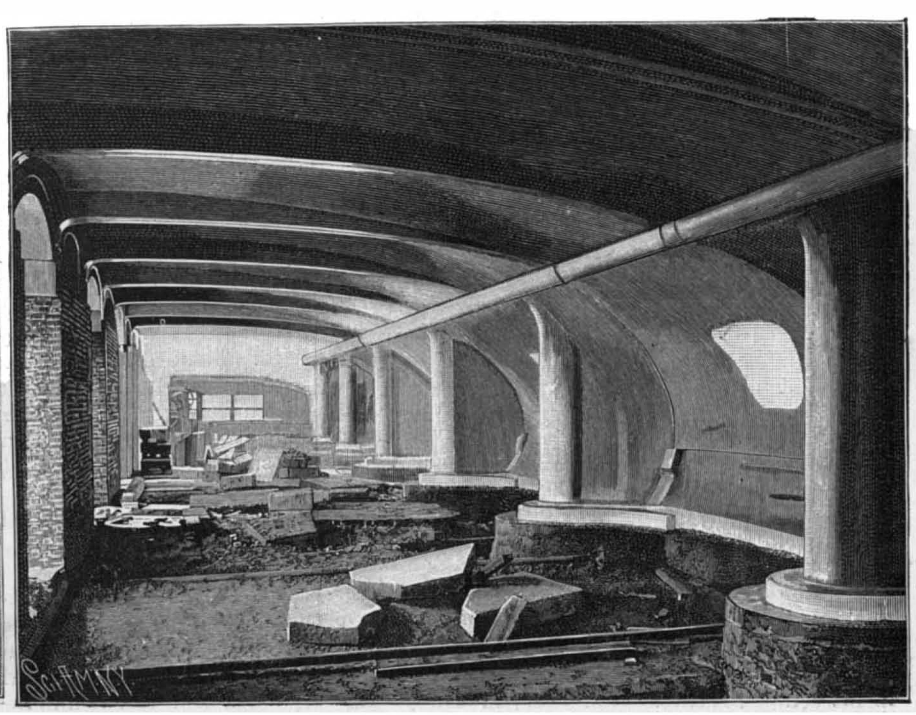


Fig. 4.—INTERIOR OF A CHILLED IRON ARMOR BATTERY.

steel was adopted ; but, as this showed too great a tendency to be racked by fire, a compound armor was constructed by welding a plate of steel on one of iron. More recently nickel-steel armor (first made by Krupp) and the Harvey armor have been much used. The latter consists of soft steel, the surface of which has been carbonized and hardened so as to give it great power of resistance.

Finally, it became necessary to use armor on coast fortifications, as it was impossible to build walls thick enough to resist the terrible force of the new guns, and even if the masonry could have withstood the high explosives in the projectiles the embrasures in such thick walls would have limited the range of the guns behind them. Plates of armor like those used for vessels were employed on land fortifications, but later chilled iron armor, which was first made by Gruson in 1860, was substituted for rolled iron armor. The great weight of the former rendered it impracticable for use on vessels, but made it especially effective in annihilating the live force of the striking projectile. It is used for stationary parapets, for batteries and for revolving turrets. Our engravings Nos. 3 and 4 show interior and exterior views of a battery made of chilled iron, for 24 centimeter guns, in course of construction. The porthole plates are curved so as to cause the attacking projectiles to slide off, and these plates are supported by pillar plates. Below the porthole plates are the pivot plates that carry the pivots on which the carriages swing, and in front of them, reaching to the lower edge of the portholes, is the glacis of beton or stone blocks. The battery is in a casemate which is protected at both ends from the shells of the enemy by heavy walls and earthworks.

Where a wide range is to be covered, armored turrets are used which are made to revolve so that the guns can be fired in all directions. Chilled iron armor of the type used for vessels is employed for these turrets, and the form and arrangement of the first ones were the same as in the turrets of monitors. Gruson was the first to undertake the construction of a turret to which chilled iron is adapted, and thus a new model for armored turrets was obtained. The cylindrical form with a flat or arched top has generally been abandoned and the preference given to a cupola-like arrangement of the whole turret, which presents no vertical surface, whereby the action of the striking projectile is very much weakened. Our illustrations Nos. 1 and 2 show a revolving cupola or turret for two 24 centimeter guns, in course of construction. No. 2 shows the cupola resting on a wrought iron base which, in turn, is revolvable on a circle of rollers. The tongues and grooves that form the connection between the separate plates are plainly shown. The gun carriages have no sidewise movement, as this is obtained by the revolution of the cupola. The guns are raised and lowered by hydraulic power, and when fired the recoil is taken by two hydraulic brake cylinders for each gun, limiting the recoil to 2 to 3 calibers. The guns return automatically to the firing position. Aim is not taken through the portholes, but through a little sight opening in the roof of the turret. The revolving mechanism and the pumping mechanism for the hydraulic power are usually operated by hand, but in France, where the turrets were intended to turn in carrousel fashion during a battle, motors were used. A brake device is provided to prevent accidental turning of the turret when only one gun is to be fired. A suitable stationary glacis is arranged on the masonry foundation and surrounds the revolving portion of the turret. This is illustrated in cut No. 1. This glacis is embedded to its upper edge in beton or granite. Forty or forty-five men are required to operate such a turret, only six of whom are needed to man the guns. Under favorable circumstances each gun can be fired about once in three minutes.

As only long cannon for direct fire can be employed in such revolving turrets and batteries—generally arranged in pairs in the former—cupolas for howitzers and mortars have to be differently arranged. These weapons are always fired at the same angle, and therefore the cupola which turns in the circular glacis can be quite flat and, on account of its light weight, be rigidly connected with the carriage, which revolves on a central pivot. Carriages of this class are especially adapted for inland fortifications and are called "armored carriages." For the shorter mortars the cupola is contracted to a sphere inclosing the mortar, only a small portion of the cupola about the opening extending from the glacis.

By the introduction of the disappearing turrets an attempt was made to obtain greater safety than could be expected with turrets which simply revolved so that only their portholes are turned from the enemy. The first of these were constructed by the Schumann-Gruson works and were arranged for small and medium sized guns, but later a disappearing turret for heavier guns was built in France by Galopin. In such turrets the moving part, which is made cylindrical and covered with a slightly arched hood, has a sinking movement as well as a turning motion, and can be lowered until its top is on a level with the glacis, so that when in loading position there is no opening exposed to the enemy and the turret itself is scarcely visible. The disadvantages of this arrangement are that the wall carrying the portholes is so straight as to have very little resisting power, and that the motors required for large plants are very expensive. The Frenchman Mougin tried to solve the question of obtaining greater safety while retaining the approved armored cupola, by mounting a comparatively flat dome on a turntable by means of a cradle, so that when tipped forward the portholes are brought under the glacis, and when the cupola is swung back the portholes return to the firing position. This pendulum turret also has its disadvantages, the chief of which is that the circular opening between the cupola and the glacis cannot be covered, and if the portions of the enemy's shells should find an entrance there, they might easily disable the turret.

We have, as yet, mentioned only fortifications which to a certain extent may be considered proof against the fire of an enemy ; that is, those in which an effort is made to supply protection against indirect as well as direct fire. In many cases, especially in coast fortifications, such overhead covering is not deemed necessary, and as a substitute for the closed revolving turrets, either the barbette turret—in which the guns fire over a stationary ring of armor—have been borrowed from armored vessels, or the disappearing carriage, designed by Moncreiff and completed by Armstrong and others, has been adopted. In the former the gunners are protected by a shield connected with the carriage mounted on a turntable. A longitudinal opening is arranged in this shield to provide for aiming the gun high, and it is closed by the barrel of the gun, which is thus left uncovered. In the disappearing carriage the gun also stands on a turntable in a basin of masonry or armor that is provided with a perfectly flat top, also of armor, which cannot be seen from a distance. If such an invisible turret is to be brought into action, the barrel of the gun is raised by means of a pneumatic device, and appears at an aperture in the roof, which is opened at the proper time, and then after being fired the gun is returned automatically, by recoil, to the protected loading position. Disappearing carriages of the front pintle form are used in batteries in which the guns are fired over an armored parapet.

Armored fortresses are found on the coasts of all civilized countries. In Germany and Italy—in the latter much has been done for the defense of its long stretch of coast—the above described Gruson chilled iron turrets are preferred, but elsewhere, as in England and the United States, disappearing carriages are more used. There are immense inland fortifications of unusual strength in Roumania, on the Russian frontier, which consist of three lines of defense about half a mile apart, the first consisting of portable armor shields for small rapid firing guns, the second of disappearing shields for medium sized guns, and the third of disappearing armored turrets. There must be from three hundred to four hundred such armored structures there, the greater number of which have been made by the Gruson works from designs of the late of Mr. Schumann. The fortifications at Bucharest must include two hundred and three armored turrets and these, as well as the fortifications on the Meuse, at Liege and Namur —with a total of one hundred and ninety-two armored turrets—were built from the plans of the Belgian engineer Brialmont. Of course, there are many armored turrets of this kind in other places, notable on the eastern frontier of France, in regard to which we have no detailed information.

As shown by the above, armor has become more and more indispensable on account of the development of projectiles, and the old competition between guns and armor is no longer restricted to naval warfare, but has been extended to warfare on land.—Der Stein der Weisen.

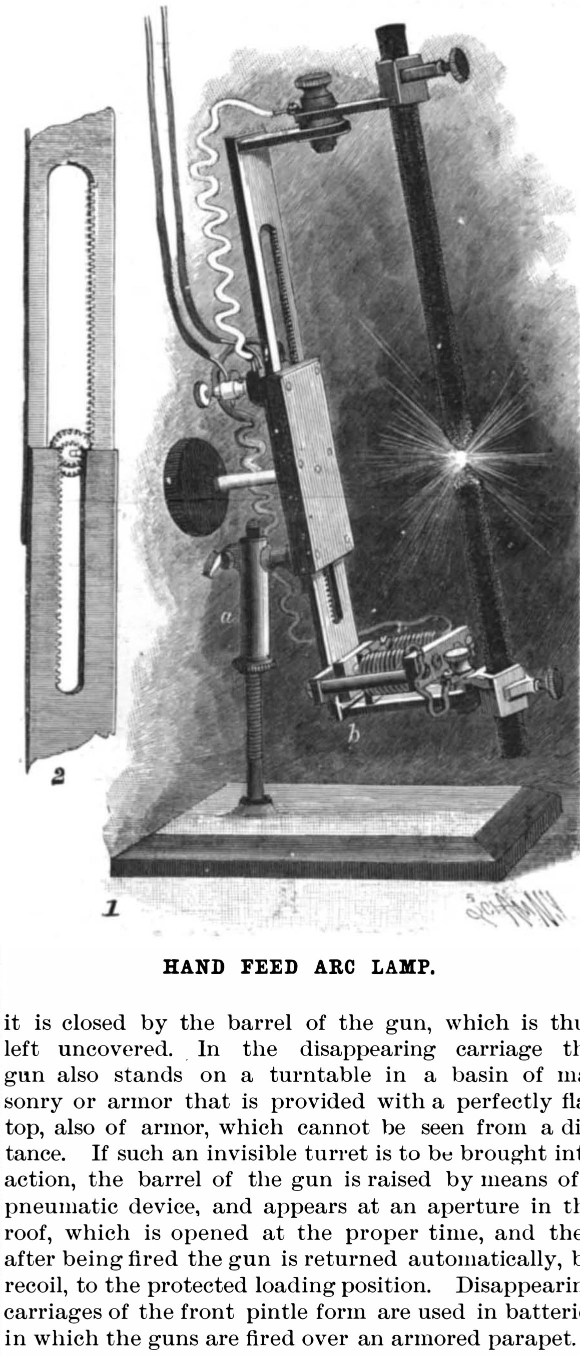
HAND FEED ELECTRIC LAMP FOR LANTERNS.

BY GEORGE M. HOPKINS.

While a good automatic lamp is undoubtedly preferable to a hand lamp for uses necessitating the absence of the operator from the vicinity of the lamp, it is certain that an ordinary hand lamp is not to be despised, and when the hand feed is supplemented with a magnetic device for striking the arc, the difference between the two types of lamps referred to is not to the disadvantage of the hand lamp when the latter is used in a lantern or for some other purpose which permits the operator to remain near the lamp, so that he may adjust it at intervals of about four or five minutes.

The lamp shown in the illustration has been used for an entire evening without a flicker. The upper, or positive carbon, is cored, and the lower, or negative, is solid, hard Carré carbon.

On the threaded rod extending upward from the base plate is placed the sleeve, a, which is connected with the slide holder so as to have a slight inclination, as is usual in lamps for lanterns, in order to expose more of the face of the crater of the upper carbon. The slide holder contains two slotted slides; the one holding the upper carbon being 7½ inches long, the one holding the lower carbon being 5¼ inches long, each being 1¼ inches wide. To the lower end of the lower slide at b is pivoted an arm extending outwardly and supporting the lower carbon-holding socket. To the arm near the joint thereof is secured an upwardly extending stud carrying an armature. An electromagnet having an elongated yoke is supported in front of the armature by brass studs attached to a brass cross arm fixed to the lower slide. A curved brass spring fastened to the armature bears on the poles of the magnet and serves the double purpose of throwing the armature back and the carbon upwardly when the armature is released, and of preventing the armature from sticking to the magnet.



HAND FEED ARC LAMP.

The upper carbon-holding slide is provided with a fixed arm extending outwardly and supporting an insulated carbon-holding socket. These sockets are connected with their respective arms by bolts, which are surrounded with soapstone insulators provided with flanges which separate the sockets and the arms. The heads of the bolts are insulated by means of mica washers. The holes through which the bolts extend are made oblong to permit of adjusting the carbons in a way to secure the best results, that is, by arranging the point of the lower carbon so that it will be slightly in front of the axial line of the upper carbon when the lamp is in operation.

In the slots of the carbon-holding slides are secured racks, which engage pinions on the spindle journaled in the slide holder (Fig. 2). The pinion for the lower carbon slide has half as many teeth as there are in the pinion for the upper slide, so that when the spindle is turned by the rubber hand wheel the carbons are moved in proportion to their relative consumption.

To an insulating strip attached to the back of the slide holder are secured two binding posts for receiving the wires connecting the lamp with the current supply. One binding post is connected with one terminal of the magnet, and the other terminal of the magnet is connected with the lower carbon socket. The other binding post is connected with the upper carbon socket.

The magnet is wound with coarse wire (No. 16 or No. 14), and the armature is adjusted to pull down the lower carbon about one-eighth of an inch. The carbon-holding sockets are formed of square brass tubing, with a screw at one angle which forces the carbon toward the opposite angle, and thus centers and aligns the carbons.

The Edison direct current is suited to this lamp when about fifteen ohms resistance is introduced in series with the lamp. A suitable range of current is eight to twelve amperes.

The great advantage of the arc striking device is that, after the carbons touch, the arc is instantly formed of the right length, thus saving the trouble of any fine adjustment by hand, and avoiding the possibility of any long continuance of a heavy current on the circuit. A very slight turn of the adjusting spindle, once in about four minutes, insures perfect steadiness. It is well to form a habit of thus regulating the arc after each change of slides. The illustrations are approximately one-third size.

Prof. Langley's Aerodrome.

Prof. S. P. Langley's invention, the aerodrome, again demonstrated, to the satisfaction of its inventor, its ability to fly, on December 12, says the New York Herald.

The latest experiment was made on November 28, when the machine, launched from a specially constructed stage, flew 1,500 yards in a horizontal direction, and when its power was exhausted gracefully dropped, until it finally rested on the water. The experiment took place on an island in the Potomac River, about thirty miles below Washington. This has been the scene of all Prof. Langley's experiments. His first successful trial of the machine was made last May, when it flew about nine hundred yards.

On account of the danger of injury to the machine by falling in the trees lining the river bank, Prof. Langley only put enough water in the engine to permit its making a flight for about one and a half minutes. The engine is large enough to carry water for about five minutes. Its flight during the experiment lasted exactly one minute and forty-five seconds—a wonderful result, when it is known that no other invention has ever flown for more than a few seconds at one trial. The machine is almost entirely made of steel, and contains a peculiar steam engine of rather more than one horse power. During the last trial the engine generated sufficient power to turn the propellers something more than a thousand revolutions per minute. The weight of the machine itself is thirty pounds, and the boiler carries two quarts or about four pounds of water. The movable parts of the machinery weigh twenty-six ounces. The fuel employed is gasolene, converted into gas before use.

The aerodrome is about fifteen feet long and measures fourteen feet from the tip of one wing to the tip of the other. Its wings are of silk and are stationary. The machine is driven through the air by means of two screw propellers, one on each side, about four feet in diameter.

In order to start the machine, an initial velocity had to be obtained, and this was secured by means of a movable table so arranged as to turn in any direction, and thus guide the flight of the aerodrome at the outset. Mr. Langley had constructed the launch engine apparatus, and on November 28 placed it on top of a houseboat. The table is on wheels, and the machine was launched from it in a perfectly horizontal line.

The only description of the work done by Prof. Langley which has recently been published from his own pen is the paper presented by him at the May meeting of the Academy of Sciences, Institute of France. We publish herewith an extract from this report, which we believe has never before been published in English. The report also contains a letter of Mr. Alexander Graham Bell, who witnessed the experiments.

DESCRIPTION OF MECHANICAL FLIGHT.

BY M. LANGLEY.*

"In a communication that I addressed to the academy in July, 1891, I said that the result of experimental researches had shown that it was possible to construct machines that would impart such horizontal speed to bodies having the form of inclined planes, and several thousand times heavier than air, that they would be able to support themselves in that element.

"I have said elsewhere in regard to this matter that other than plane surfaces might give better results, while on the other hand flight in an absolutely horizontal line, which is so desirable in theory, cannot be realized in practice.

"As far as I know, no heavy aerodrome or flying machine, so called, has yet been constructed that can maintain itself in the air by its own power for more than a few seconds, the difficulties encountered in free flight being, for many reasons, very much greater than those experienced in the flight of a body bearing in its ascension on a horizontal track, pressing upward against the under part thereof.

"Everyone knows that many experimenters have devoted themselves to the study of mechanical flight, and although the demonstration that I have furnished† of the theoretical possibility of obtaining mechanical flight with the means now at our disposal appeared to be conclusive, so much time has passed without bringing any practical result that there is reason to doubt that these theoretical conditions can ever be realized.

"I therefore thought it proper to devote myself to the construction of an aerodrome or flying machine, making use of the conclusions that I had drawn.

"Perhaps the academy will find some interest in glancing over the account that I present herewith, given by an eye witness who is well known to them, of the recent work of that machine. I am led to proceed in this manner, not only by the request of the witness himself, but also by the thought that my studies may be interrupted by the performance of my duties, so that it seems preferable to announce the degree of success that I have obtained, although this success is not complete.

"The experiment was made on a bay of the Potomac some distance below Washington. The aerodrome was, for the most part, of steel, but, nevertheless, enough lighter material was used in its construction to reduce the density of the whole to a little above 1, taken as a unit, so that the total weight was slightly less than a thousand times that of the volume of air displaced. No gas was used to lighten the machine, and the absolute weight, not including the weight of the fuel and the water, was about 11 kilogrammes; the extent of the supporting surface was a little more than 4 meters. The motive power was furnished by a very light machine having about one horse power. There was no helmsman, and the apparatus for steering the machine automatically in a straight horizontal line was imperfect.

"Another important point: The small dimensions of the machine did not permit of providing an apparatus for condensing the steam, and it could carry only sufficient water for a very limited course, inconveniences that would be overcome by a larger machine. It was supported only by the action of its screws, operated by steam, and the reaction of the air on its slightly curved surfaces.

"It will thus be seen that the speed estimated by Mr. Bell was that which resulted from a continuous ascending movement, and was much less than that which would be produced by flight in a horizontal line."

MECHANICAL FLIGHT.

LETTER FROM MR. GRAHAM BELL TO MR. LANGLEY.

"Washington, May 6, 1896.

"I know that you do not wish publicity before having attained more complete success in steering your apparatus automatically in a horizontal line, but I think that what I have been permitted to see to-day marks great progress beyond what has been done heretofore in this line and that the news of it should be spread, and I am pleased to be able to give my testimony as to the results of the two trials that I witnessed to-day, by your invitation, trusting that you will consent to its publication.

"In the first trial, the apparatus, constructed mostly of steel and operated by a steam engine, was launched from a boat at a height of about 20 feet above the water. When propelled only by its steam engine it moved against the wind, rising slowly. While moving laterally and rising constantly, it described—with a remarkably uniform and gentle movement—curves of about 100 meters in diameter, until, having turned back on its course toward its point of departure, and at a height that I estimated to be about 25 meters, the revolutions of the screws had ceased (for lack of steam, as I understood) and the apparatus descended gently and without shock toward the water, which it reached one minute and thirty seconds after it left the boat. There was no shock and so little damage was done that it was immediately ready for a second trial.

"In the second trial, which immediately followed the first, the same apparatus was launched again and took nearly the same course under similar conditions, and with very little difference in the result. It rose uniformly and without shock, describing large curves and approaching a neighboring wooded promontory, which it, however, cleared, passing the highest trees without difficulty, at a height of 8 to 10 meters above their tops, and descended slowly, on the other side of the promontory, to the bay, at a distance of 276 meters from the starting point. You already have instantaneous photography of the flight that I took just after the apparatus was launched.

"From the extent of the curves described, which I, with other persons present, estimated from measurements that I took personally, and from the indications given of the number of revolutions of the screw by the automatic register, which I examined, I estimate that the length of the course was more than half an English mile, or more accurately a little more than 900 meters.

"The time occupied by the flight in the second trial was one minute and thirty-one seconds and the speed an average of between twenty and twenty-five miles an hour (that is, ten meters per second), on a constantly ascending course.

"I was much struck by the ease and regularity of the flight of the machine in both trials, and by the fact that when the apparatus was deprived of the motive power of the steam at the highest point of its course and thus abandoned to itself, it descended each time at a uniform speed which rendered any shock or danger an impossibility.

"It seems to me that no one could witness that interesting spectacle without being convinced that the possibility of flight in the air by the aid of mechanical means would be demonstrated."

* Extract of report of the meeting of the Academy of Sciences, Institute of France, t. cxxii, presented at the meeting of May 26, 1896.

† Experiments in Aerodynamics, Smithsonian Institution, 1891.

Electric Arc in the Laboratory.

M. S. Walker expatiates upon the practical use in the chemical laboratory of the electric arc obtained from a low potential alternating current. He says it can be employed with advantage to show the effect of high temperatures upon difficultly fusible and non-volatile substances, for reduction of metallic oxides, as a partial substitute for the blowpipe in qualitative analysis and for the synthesis of certain compounds of carbon from their elements. The apparatus is arranged by fastening a cored carbon, about 10 by 1 cm., in a vertical position, so that the lower end is about 10 cm. from the top of the table. Connect by wrapping with insulated copper wire, stripped where contact is made with the carbon, then bore a conical shaped cavity 4 or 5 mm. deep in one end of another piece of cored carbon 4 by 1 cm., fix this in a wooden clamp and connect it with insulated wire as before. Connect all the wires so that the circuit will be completed if the carbons touch. The lower carbon is, of course, stationary, but the movements of the shorter piece can be controlled like a test tube in a holder. The rheostat is adjusted so that an arc $\frac{1}{16}$ to $\frac{1}{8}$ inch long can pass between the lower end of the longer carbon and the edge of the conical cavity in the smaller one, and most minerals and common metals fuse easily when a small piece is placed in the cavity. It is stated that there is practical freedom from danger when working with a 50 volt alternating current, if the apparatus is properly fixed, and that the inconvenience caused by occasional shocks is found to be less than that due to burns, etc., accidentally caused during ordinary laboratory practice.—American Chemical Journal.

Water Beneficial in Typhoid Fever.

The Bacteriological Review commends the practice of water drinking in typhoid fever, the importance of subjecting the tissues to an internal bath having, it appears, been brought prominently to the notice of the profession by M. Debove, of Paris, believed by some to have been the first to systematize such a mode of treatment. The practice of that eminent physician consists, in fact, almost exclusively of water drinking, his requirement being that the patient take from five to six quarts of water daily, this amounting to some eight ounces every hour. If the patient subsists chiefly upon a diet of thin gruel, fruit juices or skimmed milk, the amount of liquid thus taken is to be subtracted from the quantity of water. The important thing is to get into the system, and out of it, a sufficient amount of water to prevent the accumulation of ptomaines and toxins within the body. Copious water drinking does not weaken the heart, but encourages its action by maintaining the volume of blood; it also adds to the action of the liver, the kidneys and the skin, and, by promoting evaporation from the skin, it lowers the temperature.

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THE ANCIENT CITY OF COPAN.

BY C. C. WILLOUGHBY, PEABODY MUSEUM, HARVARD UNIVERSITY.

In a fertile river valley, shut in by the high forest-covered mountains of northern Honduras, are the ruined pyramids, terraces, temples and other edifices of the ancient city of Copan. Until recently little was known regarding the extent of the ruins which lay beneath the accumulated mould of centuries. Monolithic monuments of sculptured stone were scattered here and there in the almost impenetrable forest of ceiba and cedar trees. These, together with a few of the more important pyramids, were known to the natives and were pointed out to occasional travelers. The extent and real nature of the ruins, however, remained unknown until 1885, when A. P. Maudslay, an English archæologist, visited Copan, made some excavations and prepared a plan. In 1891, Prof. F. W. Putnam, of the Peabody Museum of Archæology and Ethnology, of Harvard University, organized an expedition for the careful exploration of the ancient city. For four seasons the work of excavating has progressed successfully. The forests have been cleared away and the accumulation of earth and vegetable mould has been removed from the temples, terraces, pyramids and courts of the main structure and the ruins immediately surrounding it.

The Copan River flows by the side of the principal group of ruins, and the eastern slope of the main structure has been undermined and carried away by the river floods, exposing a section which forms a cliff of rubble interspersed with walls of faced stone. This cliff is over 600 feet in length and at one point attains a height of nearly 135 feet.

The main structure covers seven acres of ground and consists of a vast irregular pile of terraces, flights of steps and pyramids crowned with the remains of temples built of squared stone. Some of the stairways and portions of both the exterior and interior of the temples were elaborately sculptured, and the buildings were originally painted in brilliant colors.

This structure contains two great courts or amphitheaters, whose cement floors are sixty-five feet above the river. Tiers of steps or seats are upon three sides of the eastern court, and the Jaguar stairway, so called from the finely sculptured jaguars which guard the lower steps, leads from the western side of the court to the terrace above.

One ascends the main structure by a flight of well-preserved stone steps two hundred and fifty feet in width. From the first landing rises a pyramid, upon whose summit are the remains of a temple one hundred feet in length. A step in front of an inner door of this temple is ornamented with seated human figures covered with elaborate breastplates and other ornaments.

The sides of the doorway and the cornice which had fallen were in like manner covered with well executed carvings in stone. Other portions of the building,

"SINGING GIRL," FROM ONE OF THE TEMPLES.

which was in an advanced stage of ruin, were elaborately ornamented with sculptures, and the wall surfaces showed traces of plaster which had been painted.

From this temple a broad flight of steps descends to an elevated court. Within this court are sculptured monuments and a broad platform with terraced sides.

Rising from the eastern side of this court is a pyramidal mound supporting a ruined temple. The sides of the pyramid are built of squared stone regularly laid in terraces. The temple is reached by a stairway divided for a part of its length by a raised structure in the form of steps, having in front rows of sculptured death's heads. The cornice of the temple was ornamented by small sculptured heads, both human and grotesque.

From the summit of the pyramid, which is 100 feet in height, one obtains a view of the extensive ruins to the south and west. Near the northern base of the pyramid is the eastern court, before referred to, nearly inclosed by ranges of steps. The northern range of steps of this court leads to a platform in front of three ruined temples, the largest of these being probably the most elaborate building of the ancient city.

In front of the principal inner doorway is a step carved upon its face with hieroglyphs and skulls, and at either end of the step is a human figure sculptured in stone, seated upon an immense skull and holding in its hand the head of a dragon, whose body, together with other figures, forms the ornamentation of the cornice over the door. The upper part of the outer wall of this temple had been ornamented by artistically sculptured half length figures in full relief, representing girls in the act of clapping hands.

Two stone incense burners in the form of grotesque heads were found within the inner chamber of this temple.

Adjoining the mound upon which this temple stands is another pyramid with three sides sloping to the level of the plane upon which the main structure is built. Upon the western side of this pyramid is the hieroglyphic stairway, one of the grandest pieces of architecture of ancient America. This stairway is about 40 feet in width, and it leads to the temple upon the pyramid, a distance of more than 100 feet. At the foot of the stairway, and occupying a central position, is an elaborately carved pedestal. The face of each step of the stairway is covered with finely sculptured glyphs composed of grotesque faces, masks, scrolls, and numerals, records of the ancient builders. Scattered throughout the debris are fragments of life sized human figures, carved in full relief, which once formed portions of the structure.

From the summit of the mound of the hieroglyphic stairway one obtains an extensive view of the Great Plaza of Copan, with its surrounding steps, terraces and mounds. The Great Plaza and its extensions occupy over seven acres, and portions of it are paved with squared stones neatly fitted together.

Within the plaza are thirteen great sculptured monolithic monuments, and before each stands a carved block of stone called an altar. The average height of these monuments is about twelve feet and the largest of them are about three feet in width and a little less in thickness. One side of the monument is usually sculptured to represent a colossal human figure wearing an elaborate headdress composed of the upper portion of the head of a quadruped, from which rise great plumes of feather work. Massive ear ornaments adorn the ears of the figure, bead necklaces surround the neck and elaborate garments of textile fabric, with tasseled fringe, cover the shoulders, and sashes, garters, bracelets and a profusion of ornaments decorate the lower portion of the sculpture.

Elaborate symbolical decorations derived from the great plumed serpent form a conspicuous part of the ornamentation, and the sides and back of these monoliths are usually covered by glyphs, which, when deciphered, will probably tell us much regarding the

RUINED CITY OF COPAN, HONDURAS, CENTRAL AMERICA, SHOWING AMPHITHEATER AND TEMPLES IN THE BACKGROUND.

personages whose sculptured representations appear upon the stones.

The altars standing before the monuments are of various sizes, and are also elaborately sculptured—some in the form of a grotesque animal or head, others having a row of human figures encircling them. The tops of the altars are frequently covered with glyphs.

Excavations were made beneath several of the monuments, and cross shaped vaults were found containing numerous jars of earthenware, some of which were decorated with well executed drawings of human figures and glyphs. The jars contained bones of small quadrupeds, sacred shells, and pigments of different colors. A few of the shells inclosed sacred objects, such as black oxide of mercury, cinnabar, worked jadeite, and a few pearls.

During the excavations a number of underground tombs were encountered, built of squared stone. These tombs were miniature reproductions of the rooms of the temples, and within them lay the crumbling skeletons of priests, surrounded with jars, food bowls, and personal ornaments, together with the paraphernalia of their priestly office.

The upper front teeth of several skeletons were ornamented with circular disks of green jadeite, highly polished, and having convex surfaces. The disks were inserted in holes drilled in the front of the teeth, and were securely fastened by red cement. The cutting edges of the incisors and canines were either ground smooth or notched.

The burial place of the common people of the ancient city has not yet been discovered. It is probable that the remains found in the tombs are of priests or important personages, and that the elaborately decorated human figures upon the monuments, stairways and buildings are effigies of gods whom the priests and rulers personified.

In studying the photographs, drawings, sculptures and other objects gathered by the Copan expedition and exhibited in the Peabody Museum at Cambridge one becomes impressed with the grandeur of the ancient city.

As to the age of these ruins, there are not sufficient data upon which to base a reliable conclusion. They are unquestionably prehistoric, and the builders of this city belonged to the same civilization as the constructors of the temples and pyramids of Yucatan. Judging from the ruined condition of the edifices of Copan, this city must be older than most of the cities of Yucatan, and more magnificent also.

THE APPEARING LADY.

BY WILLIAM B. CAULK.

Of the many new illusions now being presented in Europe, an ingenious one is that of the appearing lady, the invention of that clever Hungarian magician Buatier de Kolta.

On the stage is seen a plain round top four leg table, which the magician has been using as a resting place for part of the apparatus used in his magic performance. Eventually, the performer removes all articles from the table and covers it with a cloth that does not reach the floor. Cut No. 1 represents the table in this condition. On command, the cloth gradually rises from the center of the table as though something were pushing it up. In a few moments it becomes very evident that some one, or something, is on the table covered by the cloth. The magician now removes the cloth and a lady is seen standing on the table, as in illustration No. 2.

The secret of this, as in all good illusions, is very simple, as the third illustration will show. In the stage there is a trap door, over which is placed a fancy rug that has a piece removed from it exactly the same size as the trap, to which the piece is fastened. When the trap is closed the rug appears to be an ordinary one. The table is placed directly over the trap. Below the stage is a box, open at the top, with cloth sides and wood bottom. To this box are attached four very fine wires, that lead up through the stage by means of small holes where the trap and floor join, over small pulleys in frame of table and down through table legs, which are hollow, through the stage to a windlass. In the table top is a trap that divides in the center and opens outward. The top of the table is inlaid in such a manner as to conceal the edges of the trap. The lady takes her place in the box in a kneeling position, the assistant stands at the windlass, and all is ready. Fig. 1 shows the arrangement beneath the stage, and Fig. 2 the under side of the table top.

The magician takes a large table cover, and, standing at the rear of table, proceeds to cover it by throwing cloth over table, so that it reaches the floor in front of the table, then slowly draws it up over the table top. The moment that the cloth touches the floor in front of the table, the trap is opened and the box containing the lady is drawn up under the table by means of the windlass, and the trap closed. This is done very quickly, during the moment's time in which the magician is

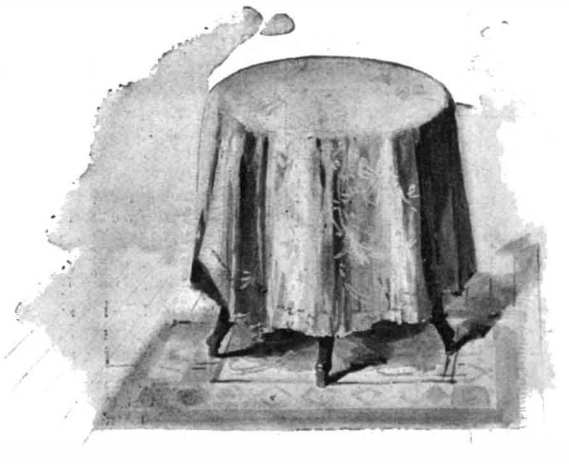
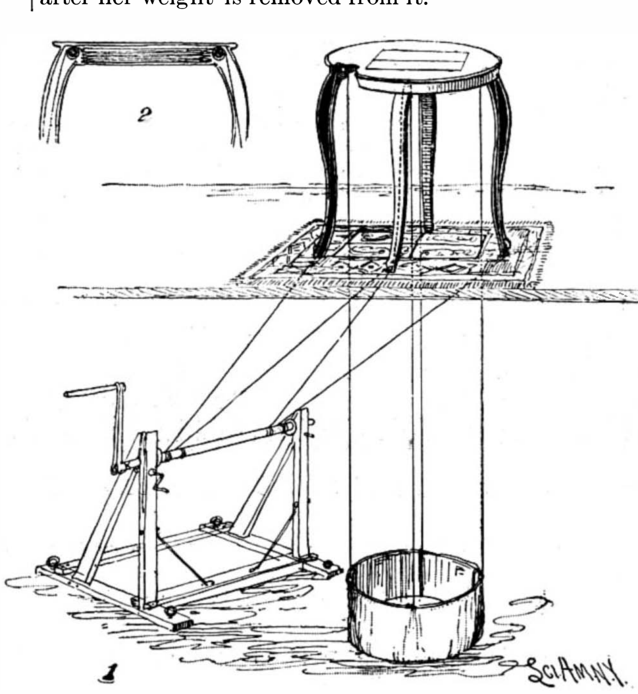


TABLE READY FOR THE APPEARANCE.

straightening out the cloth to draw it back over the table. All that now remains to be done is for the lady to open the trap in table and slowly take her place on top of the table, and close the trap.

The top and bottom of the box by means of which the lady is placed under the table are connected by means of three strong elastic cords placed inside of the cloth covering. These elastics are for the purpose of keeping the bottom and top frame of box together, except when distended by the weight of the lady. Thanks to this arrangement of the box, it folds up as the lady leaves it for her position on the table top, and is concealed inside of the frame of table after her weight is removed from it.

THE APPEARING LADY—STAGE ILLUSION.



DETAILS OF THE APPARATUS.

Ruins of Ancient Troy.

Dr. Wilhelm Dörpfeld, the first secretary of the Imperial German Archæological Institute of Athens, came to this country to attend the commemorative exercises at Princeton University and incidentally delivered a number of lectures of great interest at Columbia University, the Brooklyn Institute, etc. Dr. Dörpfeld is an industrious explorer of the remains of classical antiquity on the site of Troy, at Olympia and elsewhere, and his researches have given him an enviable reputation as one of the leading archæologists of the world. His lecture on "Troy and the Homeric Citadel" was very interesting.

The question of the site of Homer's Troy was briefly reviewed by the lecturer, as it has been discussed in ancient and in modern times. The views of Strabo, of Demetrius, and of modern scholars were briefly set forth, and the results of Schliemann's excavations and the careful and successful work of Dr. Dörpfeld himself were dwelt upon at some length. On the site now proved to be the place where Homer's Troy stood, the excavations have revealed nine strata of earth and ruins, representing recognizably distinct periods in the history of the three cities that have there been built—first the prehistoric, before Homer's time; then the Greek, the city of Priam; lastly, the Roman city. In the uppermost, or ninth, stratum were found a temple, theater, and other buildings of unmistakably Roman construction, with many inscriptions which show that the name Ilios is historic. Below this, in the eighth and seventh strata, are the remains of small houses of the Greek city, with evidences of fortifications of no great magnitude. In the sixth stratum is an acropolis, with many buildings and storehouses, strong fortifications, marked by towers and gates. Mycenæan vases, the painted archaic terra cottas that are not later than 700 B. C., found in this stratum determine its date to be that of the Trojan war, as told by Homer—that is, between 1500 and 1000 B. C. In the fifth, fourth, and third layers, period unknown, prehistoric objects occur. Still deeper, in the second stratum, are the foundations of the acropolis hill, with sumptuous houses built of unburned brick. The wall of the acropolis is massive, with towers and gates, and shows signs of having been several times rebuilt. Here is the "treasure house of Priam," about which Schliemann had so much to say. In the first stratum, the lowest of all, the town walls rest upon the rock. Other articles discovered are of an unknown antiquity.

Summing up the testimony of these resources, which he explained in detail, showing their significance by means of pictures upon the stereopticon screen, Dr. Dörpfeld declared that the upper stratum, the ninth, was clearly made up of the ruins of the Roman city of Ilion. The Greek settlements of various periods visited by Demetrius, Alexander, and Xerxes have left their traces in the eighth and seventh strata. In the sixth stratum have been found the remains of the Homeric Troy, the city of which the siege and capture, with the varying fortunes of the war for the punishment of Helen's ravisher, formed the subject of the Iliad. The excavations below this base revealed only prehistoric—that is, pre-Homeric—objects and remains.

So, in conclusion, the lecturer declared that the question of Troy was solved. ("Die trojanische Frage ist gelöst"). The site, the very existence, of the city had furnished the subject of learned research for 2,000 years. The most recent excavations had settled all doubt as to the existence, the site, and the character of the city. The citadel of Troy he held to be the most interesting group of ruins now accessible to the investigator of classical antiquity and of ruins still more remote.

The Roentgen Rays in Pharmacy.

Dr. Ferdinand Ranwez has made use of the X rays to detect mineral substances added to saffron as adulterants, says the Pharmaceutical Journal. Out of four specimens so examined, only one was found to be pure; another contained 62·13 per cent of barium sulphate, and a third 11·75 per cent of that compound, together with a certain proportion of potassium nitrate. The fourth specimen contained 50 per cent of pure saffron, and the rest consisted of some substitute for that drug, faced with barium sulphate to the extent of 28·6 per cent. The plan adopted was to wrap a gelatino-bromide plate in black paper, place the saffron upon this on the same side as the sensitive film, then allow the rays to act for four minutes, afterward developing and fixing in the usual manner. The foreign matter is very sharply indicated in the print illustrating the paper, in the Annales de Pharmacie for May.

RECENTLY PATENTED INVENTIONS.

Engineering.

SMOKE CONSUMING FURNACE.—Joseph W. Hogan, Atlanta, Ga. This improvement is designed especially for application to locomotive boilers, there being in the smoke box a receiver or superheater connected with the exhaust pipe, while an offtake, provided with an automatic governor valve, discharges a blast upwardly into the stack, and a second offtake leads from the receiver to the head of the boiler, where it has a check valve and a branch pipe discharging into the fire box. A live steam pipe leads from the top of the boiler to the branch pipe, an automatic regulating valve opening when back pressure in the branch pipe decreases sufficiently.

GAS GENERATOR.—Jesse E. Hathaway, Santa Fe Springs, Cal. For the generating of gas from crude oil, kerosene, gasolene, etc., for use as a motive agent in gas engines, this generator has been especially designed, being of strong and simple construction and very effective in operation. It comprises a vertical exhaust pipe through which pass the hot products of combustion from a gas engine, while a coil of pipe in the exhaust is connected at one end with the oil supply and discharges the generated gas at the other end into a gas reservoir surrounding the exhaust pipe, there being a safety valve at the upper end of the coil, and a removable cap at the lower end of the vertical portion of the exhaust pipe, to introduce fuel to heat the coil when the engine is started.

CARBURETER.—Edward I. P. Staede, Mankato, Minn. This invention affords a simple device to carburet air by forcing it through gasolene or other volatile fluids, using the heavier portions of the fluid first, and leaving the lighter portions till the last, thus producing a uniform quality of gas. The carbureter tank has an air supply pipe and a gas offtake pipe, and near the bottom of the tank is an air chamber connected with the air supply pipe, coils within the chamber having their ends carried, one upwardly and the other downwardly, and each coil having an inlet opening within the chamber at the junction of its downwardly extending member with the body. The air will be forced a considerable distance through the gasolene with but little pressure.

Railway Appliances.

FLUID PRESSURE BRAKE.—Alexander Dallas and Oscar P. Amick, Herington, Kansas. This improvement is designed to facilitate the equal charging of the auxiliary reservoir and a prompt releasing of the brakes at the same time, and consists of a feed valve connected with a train pipe, an auxiliary reservoir, and a triple valve for recharging the auxiliary reservoir while the brakes are releasing. The invention covers some novel parts and details, in which there are no springs to get out of order, and but a single valve is employed.

Electrical.

LAMP.—Louis A. Jackson, New York City. This is a lamp more especially adapted for use on bicycles and wheeled vehicles, and is of such simple construction that it may be manufactured at small cost. It comprises a lamp and battery arranged in compact form, the lamp not liable to be extinguished by jar. The lamp is supported on a suitable metal casing in which is a series of cells, the shell of each forming a battery element, a rheostat being supported by the cover and having electrical connection through the casing with the lamp filament, there being a contact between the lamp filament and one of the cell shells, and means for closing the circuit between the rheostat and battery.

Mining, Etc.

MINERS' AND BLASTERS' TOOL.—Martin Killian, Central City, Col. This tool combines in one article knives for splitting the fuse or cutting it into lengths, a device for fastening the caps on the fuse, a cutter for any kind of wire and a knife and punch, the tool being as compact as an ordinary pair of pliers and one which may be readily carried in the pocket. The knives are held in place by set screws, and may be readily removed when dull, broken, or injured, to be replaced by others.

WELL POINT.—Henry K. Brearley, West Duluth, Minn. This is a tool designed to pass through ore, clay and rock much easier than the point ordinarily used, and comprises a tapering tubular body with closed lower end and spiral exterior flanges forming opposite cutting edges, the body having openings at intervals in spiral order from top to bottom. The point is designed to receive water and particles of earth and rock, the latter following the pipe on the outside to the surface, and indicating the nature of the strata through which the point is passing.

Mechanical.

HORSE SHOE MACHINE.—John W. Crow, New York City. To bend the metal bar or blank from which a shoe is formed into the proper curved shape at one operation, this inventor has devised a machine which comprises a blank supporting table over which reciprocates a plunger carrying a die adapted to engage the bar, pivoted levers being engaged and moved by the plunger, and the levers engaging the end portions of the bar and bending them around the die on the plunger. The machine is of strong and inexpensive construction.

SCREW DRIVER.—Hiram F. Henry, Cleveland, Ohio. This is a tool with which one may work the handle rapidly forward and backward, to drive or withdraw the screw, without disengaging the shank from the screw slot and without adjusting the parts. On the lower end of the handle is a tooth-faced portion adapted to engage a similar portion on the upper end of the bit shank, the teeth of the two portions being held out of mesh by a coil spring around the parts, which are all surrounded by a cap. The handle is pressed inward in screwing or unscrewing, the removal of pressure on the handle disengaging the teeth of the handle part from those of the bit part.

MACHINE TO FORM ORGAN PIPES.—Herbert Richardson, London, England. In a suitable frame are mounted two rollers, one end of each roller being extended beyond the adjacent end of the other roller and there being a hand wheel fixed to each extended end, whereby the rollers may be manually turned in opposite directions, a deflecting roller being movable toward and from the space between the first rollers. The machine affords a simple construction by which sheet metal may be readily rolled to form different sized pipes of uniform diameter, the two sides of the pipe, when removed from the machine, springing together to form a complete pipe.

Agricultural.

POTATO DIGGER.—Edmund B. Frink, Oxford, Mich. This is a machine of light draught, designed to work as well on hilly as on stony ground, and having a wheel supported frame by which is carried a shovel adapted to enter the ground and loosen the potatoes, drawing them up to the surface, the work of which is completed by a rake whose teeth raise and free the potatoes from dirt, at the same time removing the tops and depositing the potatoes at one side in windrows. The bowed or arched axle of the machine is raised or lowered as desired, by means of a lever, to carry the frame to or from the ground.

CULTIVATOR OR PLOW.—Ferdinand Reimers, Davenport, Iowa. This invention provides means by which the horizontal or lateral adjustment of the plow may be readily accomplished while riding on the machine. The plow beams are pivoted to swing horizontally, there being a shifting lever on each side of the cultivator pivoted to swing vertically, and there being connections between the levers whereby their movements will alternate, there being also bevel gears on the levers and on the plow beams. With this improvement the shovels of a riding plow or cultivator may be quickly and easily operated by the feet of the user.

CULTIVATOR BEAM COUPLING.—Gideon D. Mitchell, Newton, Kansas. This invention provides a coupling capable of receiving round axles of various diameters and which will have a free rolling bearing on the axle of the cultivator, enabling the operator, upon moving the plows to or from the vegetation, to carry the coupling proportionately and in the same direction along the axle, thus bringing the plows at all times square to the work and obviating the prolonged and tiresome holding of one or the other, or both of the plows, with a tendency to draw away. The coupling has friction rollers between which the axle is received, and some of the rollers are adjustable and provided with locking devices.

IRRIGATING PLANT.—Allan W. Towne, Pomona, Cal. For irrigating lands, and especially orchards, this invention provides for the employment of an inclined trunk pipe in which are gates and a number of hydrants arising from the trunk pipe between each gate, the discharge orifices of the hydrants being in the same plane. The trunk pipes are run from head to foot of an orchard transversely of the furrows, and water is first supplied by the hydrants of the upper sections, and then the following lower sections in order.

Miscellaneous.

STOVE PIPE SHELF.—Abram H. Smith, Vancouver, Canada. This invention provides an adjustable shelf for attachment to the draught pipe of a stove pipe or range, for drying or warming dishes or keeping food warm. It consists of a sheet metal band having a novel clasping device by which the band may be readily secured on stove pipes of different diameters, the band having a row of spaced perforations in which may be secured the wires of a shelf produced from a single wire strand, the shelf comprising a series of radiating braced arms held projected from the band.

GAME APPARATUS.—Helen M. Van Kuran, Chicago, Ill. This invention relates to a game for children and young people, designed to teach the colors of the solar spectrum and their tints and familiarize the players with the names and forms of bodies of the solar system, geographical forms and representations of animal and plant life. The game board is divided by a central line, at each side of which are corresponding belts bearing standard colors of the spectrum, each belt having objects bearing color names duplicated at each side of the center line, while there are also checkers bearing the corresponding objects and colored with the tints of the belts to which they belong. The players cover the objects with the checkers, to compete in covering all the figures, and first build a central column of a cube, a cylinder and a sphere.

MAKING NITRITES.—Lewis G. Paul, Huddersfield, England. This invention is for a process of making nitrites of soda and potash from their nitrates by the use of sulphur and caustic soda or potash, the method consisting in heating the nitrates with the caustic alkali and adding sulphur gradually to the melted mass. The temperature is kept at such a degree that the sulphur does not deflagrate when added to the melt, and when all the sulphur has been added the temperature is raised until the melt becomes thinner and eventually almost clear.

MUSICAL INSTRUMENT.—Bruno E. Wollenhaupt, New York City. This invention is for an improvement on a formerly patented invention of the same inventor, for a sympathetic vibrating device for violins, guitars, mandolins, etc., greatly increasing the volume and duration of tone without rendering it more difficult to play the instrument. Within the body is arranged a sounding support or bar on which are secured one or more combs, each having a number of teeth or prongs corresponding with the different tones that can be produced on the exterior strings. The sounding support is arranged above the bottom of the body, which resonates fully, so that the quality of the instrument is not diminished by the vibrating device, but is increased by the soft and sweet tones emanating from the combs, sounding in sympathy with the tones played on the strings.

MUSICAL INSTRUMENT VALVE.—Hiram F. Henry, Cleveland, O. A distension valve for cornets and similar instruments is provided by this inventor, the construction being simple and designed to prevent sidewise motion of the valve by the buckling of the compression springs now used. The valve is fitted in a casing, with a coil spring encircling its stem and connected at its lower end with the valve, while at its upper end is a circular bearing concentric with the valve. As the valve is depressed, the spring is distended and overcomes the crowding over of the valve against one side of the casing.

RIB TIP HOLDER FOR UMBRELLAS, ETC.—Heyward Scudder, Boston, Mass. To hold umbrella ribs against the stick or handle, preventing their needless play about the stick and giving the umbrella a neat appearance, this inventor provides a simple and inexpensive device, comprising split pins driven into opposite sides of the stick, the parts of the pin constituting spring sections, and the heads of the pins engaging eye portions of wire clamping sections adapted to engage and hold the ribs securely against the stick or allow them to be readily removed therefrom in opening an umbrella or parasol provided with the improvement.

STOP BOX.—Isaac Sorsoleil, Owatonna, Minn. This is an improvement relating to municipal water and gas supply, and readily adjustable according to the depth of the water or gas supply pipe. It comprises a pipe adapted to surround the valve stem and having at its upper end a head formed with a cam having an elongated tangential aperture, the cover of the head fitting loosely and having also an aperture, while a bolt extends through the apertures of the cam and of the cover, and has an arm extending at an angle to its shank. The head and pipe are turned, to screw the latter up or down in the casing, by means of a forked tool.

SHEET METAL CAN.—Frank H. Palmer, Brooklyn, N. Y. A can having a tight cover joint, but of which the cover may be readily removed by prying with a screw driver or similar tool, is provided by this inventor. In the top of the can is a large central opening, around which is a depressed ring to receive a packing which is formed on the under side of and near the edge of the cover, while inside of this ring the cover has a central depressed portion adapted to fit into and impinge upon the edges of the central opening in the top of the can body. The cover is simply pressed down into position to close the can, the packing ring being simultaneously forced to place to make a tight joint.

BREAD BOX AND SLICER.—Charles Person, St. Joseph, Mo. For hotels, boarding houses and other places where large quantities of bread are used, this inventor has devised a box for holding the loaves and provided with means for slicing them. The invention comprises a loaf feeding device, a rotary cutter, a frame on which the parts are mounted, and a compartment box within which they may be removably placed. When the slicer is operated in the box the severed slices fall into a lower compartment, but the slicer may be operated separately from the box.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

EVERYBODY'S MEDICAL GUIDE. A handbook of reliable medical information and advice. By M. D. (Lond.) London: Saxon & Company. Price 50 cents.

This little book, by an author whose name is not stated, from its size and make up and treatment appears to be a good work, and its shape makes it particularly adapted for traveler's use. It seems not at all in the order of a work designed to supply the care of a physician, for it does not pretend to do so, which adds to one's opinion of it. It is written from an English standpoint.

WESTINGHOUSE ELECTRIC STREET CAR EQUIPMENTS. By Frederick L. Hutchinson and Leo A. Phillips. East Pittsburg, Pa. 1896. Pp. 91, xvii. Price $1.

THE NATIONAL ELECTRICAL CODE. An analysis and explanation of the underwriters' electrical code, intelligible to non-experts. By Pierce and Richardson, electrical engineers, Chicago. Chicago, Ill.: Charles A. Hewitt. Pp. 222. Price $2.

The title page explains the scope of this work. It is designed to present the fire insurance underwriters' views of the electric light question to avoid interference of wiring and connections with the insurance policy.

FRICTION, LUBRICATION AND THE LUBRICANTS IN HOROLOGY. By W. T. Lewis. Chicago: George K. Hazlitt & Company. 1896. Pp. 95. Price $1.

This excellent monograph is one that should be in the hands of all jewelers and of those who deal in or handle the finer class of machinery. It seems to us that the author has almost done himself an injustice in confining his topics to watches and clocks, for people have now at last waked to the idea that a lubricating oil should be good. The superlative of lubricating oil as well as the methods of employing it are to be found in the watchmaker's practice.

THE WATCH AND CLOCK MAKER'S HAND BOOK, DICTIONARY AND GUIDE. By F. J. Britten. Ninth edition. London: E. & F. N. Spon. New York: Spon & Chamberlain. 1896. Pp. 459. Price $2.

In this work we have another and quite elaborate contribution to the watch and clock maker's industry. The elaborately illustrated dictionary and cyclopedia is descriptive of the methods, applications and operations of the art. It is very thoroughly illustrated. It is alphabetically arranged, the only break in the alphabetical order being due to divisions of the subjects. There is no index, but cross references are supplied, which to a great extent will take the place of the index, and make it unnecessary.

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.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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.

(7054) R. L. asks how to run a cyanide copper bath so that the metal deposited will not peel off during deposition or during the final buffing process. A.

1. Cold Bath for Iron and Steel.

Acetate of copper	3 oz.
Carbonate of soda	$6\frac{1}{8}$ "
Bisulphite of soda	$3\frac{1}{8}$ "
Cyanide of potassium	$3\frac{1}{4}$ "
Water	1 gal.
Aqua ammonia	$2\frac{1}{8}$ fl. oz.

2. Warm Bath.

Acetate of copper	$3\frac{1}{8}$ oz.
Carbonate of soda	$3\frac{1}{8}$ "
Bisulphite of soda	$1\frac{1}{8}$ "
Cyanide of potassium	$4\frac{1}{2}$ "
Water	1 gal.
Aqua ammonia	$1\frac{4}{8}$ fl. oz.

3. Hot or Cold Bath for Tin, Cast Iron, or Large Zinc Pieces.

Acetate of copper	$12\frac{1}{2}$ oz.
Bisulphite of soda	10 "
Cyanide of potassium	18 "
Water	$5\frac{1}{8}$ gal.
Aqua ammonia	7 fl. oz.

The metal must be chemically clean in either case.

(7055) A. P. S. asks: 1. What is the formula for making the household ammonia? Or an ammonia of equal commercial strength? A. SUPPLEMENT, No. 1080, gives formula for making household ammonia. 2. What will remove mildew from fine white goods? Is not chloride of lime sometimes used for bleaching muslins, and if so, kindly state in what manner? A. To remove mildew stains, mix together a spoonful of table salt, 2 of soft soap, 2 of powdered starch, and the juice of a lemon. Lay this mixture on both sides of the stain with a painter's brush, and then lay the article on the grass, day and night, until the stain disappears; or get a piece of flannel, dip it in whisky, and well rub the place marked; then iron on the wrong side, taking care to put a piece of damp cotton cloth between the iron and silk, and iron on the cotton cloth, which will prevent the silk assuming a shiny, glazed appearance; or wash clean and take every particle of soap off, then put the linen into a galvanized bath or tub full of clean cold water, procure a little chloride of lime, and tie it up in a muslin bag or piece of muslin, dissolve the time in lukewarm water by squeezing the bag, then pour the water among the clothes. Stir and leave them for twenty-four hours, but do not put too much lime in or you will rot the clothes; then well rinse in clean cold water; or hypochlorite of alumina is said to be one of the best remedies. Moisten with water, rub well into the cloth, moisten again with dilute sulphuric acid (1 to 20), and, after half an hour, rinse thoroughly in soft water and then in water containing about an ounce to the gallon of sulphite or hyposulphite of soda. A stiff brush may be advantageously employed in applying the hypochlorite. Chloride of lime will rot the muslin.

(7056) H. B. asks: 1. How can I compute the amperage of a primary battery? A. There is no satisfactory way of doing this; the amperage changes constantly, rapidly diminishing as the battery is in use. 2. Is it not well to have amperage of battery a little higher than necessary for a certain work and regulate the amount of current passing through the wire by number of cells? A. It is always well to have an excess of amperage available. Reduction by resistance or by cells is not economical, but the excess of amperage is pretty apt to be seriously diminished in practice. 3. Does plaster of Paris make good porous cups? A. No. It may be used as an expedient only. 4. When porous cup is used is it still necessary to take zinc out when current is not passing? A. Yes; as the porous cell only retards diffusion, but does not stop it. 5. Will you explain what is meant by watt? A. A watt is the product of one volt by one ampere—the volt-ampere. It is the unit of power or of rate of expenditure of energy.

(7057) H. H. asks: 1. What is the reason for winding large wire on fields and small wire on armature of small motor, the armature of three pole type? A. The armature winding is in parallel. Therefore, it has twice the carrying capacity of the wire it is wound with, and but one-sixth the resistance. Hence fine wire can be used for it. The general rule for dynamos is that for series winding the field should have ⅔ the resistance of the armature; for shunt winding the product of the field and armature resistances should be equal to the square of the external resistance. The sizes and lengths of wires are based on these and similar considerations. The effect of too few turns of wire on a motor armature is to give high speed, with danger of burning out. 2. Can I use the number of amperes that my armature wire will carry to run my motor, irrespective of the number of volts? A. Yes. 3. I have a current of one ampere at six volts; what size of wire should field be wound with, also what resistance should I wind armature to secure the best results? The motor to be about the size of No. 1 Porter motor made by the Leavitt Company. A. Use No. 23 wire on field and No. 26 on armature. The resistance cannot be stated from data given. Wind the armature full. 4. Would I be able to use the same winding for 6 volts and 2 amperes? A. Use wire two or three numbers larger.

(7058) S. C. McK. asks: 1. Is there any glue, paste, or cement that is a good conductor of electricity, as good as carbon, when dry? A. No; unless carbon or finely divided metal be mixed with it. 2. Is there a nonvolatile liquid that is a good conductor of electricity? A. Mercury. 3. Can you approximate the pressure and amperage of a battery cell made as follows: Two Edison-Lalande zincs (type Q) suspended in a regular caustic potash solution (charge for type Q) covered with paraffine oil, the whole contained in a carbon cell (plumbago crucible)? I cannot get at the area of carbon in contact with the liquid, but you may be able to approximate it. I have two of these cells and they are very satisfactory. Have not worked them much on closed circuit, but have not been able to notice any falling off of current due to polarization. There are some pieces of copper oxide in the bottom of cells. A. 0·667 volt 9·5 amperes maximum current. 4. What property of carbon renders it so indispensable to the construction of telephone transmitters? A. Its granular nature, causing it to vary in resistance with pressure, either as regards surface contact or internal resistance.

(7059) J. O. H. writes: In looking over some back numbers of your paper, in query column, you state that cast iron can be brazed or soldered. Will you please inform me where I can find directions in regard to doing same, especially to braze? A. The soldering and brazing of cast iron requires care to have the surface perfectly clean by scratching with a file and then rubbing the surface with a piece of zinc and sal ammoniac dissolved in water, when the surface can be tinned with a soldering copper, or brazed with borax and flux, using low brass. Another plan is to scratch the surface with a bundle of brass wire made up like a brush, thus coating the surface with brass, and so adapting it for soldering.

(7060) G. G. writes: 1. I have several brick tanks to build, circular, 10 feet diameter and 10 feet high. Will a coating of paraffine wax applied hot to the inside prevent leakage of water? Will it be permanent? If not successful, can the tank be afterward coated with cement? A. We cannot recommend the building of tanks as described. The brick is very porous, and unless the paraffine is heated on the face of the brick, it cannot be driven in sufficiently to make a permanent and watertight tank. The tanks should be built with the best Portland cement and plastered with the same and troweled smooth. Then, for a more perfect waterproofing, paraffine the surface of the plaster by heat. The plaster will not stick to a paraffined surface.

(7061) E. & E. ask whether platinum used as contact pieces in boilers is liable to corrosion from the water used in them, and in places where boilers scale, will the scales fasten themselves to the platinum? A. The metal will not be apt to corrode, but will very likely become covered with scale.

(7062) J. F. F. asks for a rule for figuring the number of candle power for lighting buildings, stores, etc., by electric lights. How many cubic feet of space will one candle power light? A. No general rule can be given, as the light required is affected by so many conditions. The color and nature of the wall or wall paper, hangings, furniture, and carpets, are all concerned, as well as the use to be made of the room, taste of the occupants, etc. Again, if frosted bulbs are used half or three-quarters of the light is lost, and cut glass or ornamental globes may cut down the light to one-fifth of its normal value. You can estimate on the basis of three 16 candle power incandescent lamps to each two gas burners which would normally required.

(7063) W. C. G. asks if a one horse power engine making only 200 revolutions a minute will run the dynamo in No. 600. A. It will if proper belt wheels are used to increase the speed. Two hundred revolutions per minute are not sufficient for the dynamo.

(7064) E H. asks: What is the coefficient of friction in a bicycle chain? A. It cannot be accurately stated. The perfection of the chain and its lubrication make a very great difference. If the chain is too tight, the friction will increase enormously. The chain should be very loose. The whole subject of friction is treated in a series of papers by Prof. Hele Shaw, in our SUPPLEMENT, Nos. 572, 573, 574, 575, and 576, to which we refer you. In our SUPPLEMENT, No. 1077, is an excellent article on mechanics of the cycle. Chain friction is not directly treated in any of these SUPPLEMENTS.

(7065) M. O. asks: 1. What is the pressure in pounds per square inch of acetylene gas and air exploded, as in the cylinder of a gas engine? Also about what proportion of air and gas would make the strongest explosion? A. We have no records of this pressure. The fact that acetylene gas may itself be exploded under certain conditions goes to still further complicate the problem. Two volumes of gas should have twenty-five volumes of air for perfect combustion or explosion. 100 to 150 lb. per square inch would be a fair allowance. 2. About what would be the difference in regard to power between acetylene and gasoline? A. Gasoline would be much more powerful. 3. Is there any book or papers on the subject? A. We recommend, and can supply, "A Textbook on Gas, Oil and Air Engines, or Internal Combustion Motors Without Boilers," by Bryan Donkin, new edition, price $7.50 mailed; also "The Gas and Oil Engine," by Clerk, new edition, price $4 mailed.

(7066) M. C. asks: 1. I have a small induction coil wound with 8 ounces double silk No. 36 on the secondary and I have one with 4 pounds double cotton covered No. 35 on the secondary, and 1½ pounds on primary of No. 14 double cotton covered, and the small coil with 2 cells battery gives more shock than the large one; is that natural on account of the size, as the large one gives more of shock, as more battery power is applied? A. If of generally similar construction and proportions, the large coil should be more powerful than the small one. It may be a question of insulation or of insufficient primary. A short circuit will make an immense difference. 2. How many volts will I need to get a 4 inch spark from the large coil dimensions as given? A. Divide turns in secondary by turns in primary; divide 400,000 by the quotient to get the voltage required in primary. This rule is only approximately correct. 3. Have you any work on how to make an ampere meter? A. See our SUPPLEMENT, Nos. 618, 628.

(7067) O. P. W. says: Will you please give me in Notes and Queries column a receipt for a durable lacquer for brass, colorless preferred, such as is used by instrument makers? A. 1. For colorless lacquer use thin white shellac varnish which has been filtered. 2. Seed lac, dragon's blood, annatto, and gamboge, each 4 ounces; saffron, 1 ounce; alcohol, 10 pints. 3. Turmeric, 1 pound; annatto, 2 ounces; shellac and gum juniper, each 12 ounces; alcohol, 12 ounces. 4. Seed lac, 6 ounces; dragon's blood, 40 grains; amber and copal, triturate in a mortar, 2 ounces; extract of red sanders, ½ drachm; Oriental saffron, 36 grains; coarsely powdered glass, 4 ounces; absolute alcohol, 40 ounces. Very fine.

(7068) C. L. M. asks if there is anything which will loosen up blue vitriol when it has caked in the bottom of a jar of gravity battery—frozen I think it is called. I have charge of the fire alarm here, and have quite a number of jars which are useless because the copper is frozen in. A. Try filling a tub with water, and immersing completely in it the jars, turn them upside down, keeping them absolutely full of water, allowing no air to enter. This may loosen it so that it will come away. Solution of the copper in nitric acid is rather expensive. You can, however, dissolve it in a mixture of sulphuric acid and sodium nitrate. This is cheaper than nitric acid.

(7069) L. H. G. asks: 1. What is the candle power of a nine ampere arc light? A. Nominally about 2,000 candle power, really about 800 candle power. 2. Does adding salt to coal in consuming injure the grate, and if used under a boiler, injure the boiler steel? A. It will not be apt to injure the grate. It might tend to corrode the boiler, especially if the latter were out of use and cold after its use.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

DECEMBER 8, 1896,

AND EACH BEARING THAT DATE.

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

Abrading articles, composition of matter for, E. G. Acheson 572,852
Air brake, W. Mable 572,553
Alkalies, manufacturing phosphates of, H. Albert 572,512
Animal trap, self-setting, F. E. Kruth 572,811
Armor plates, apparatus for manufacturing, Wilson & Stubbs 572,590
Axle and axle box, M. F. Bishop 572,925
Axle box and bearing, car, J. R. Baker 572,517
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Baby walker, G. F. Packard 572,613
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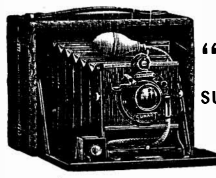

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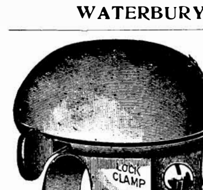

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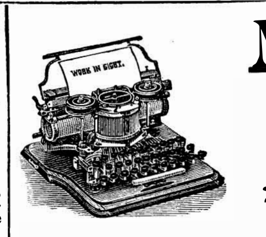

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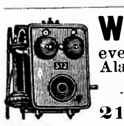

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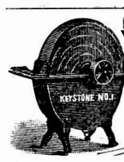

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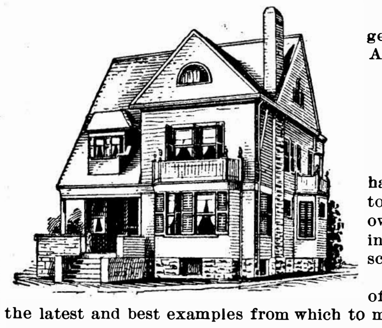

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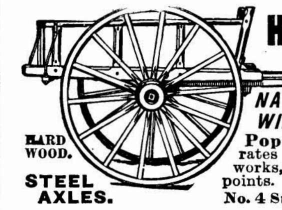

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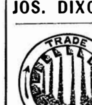

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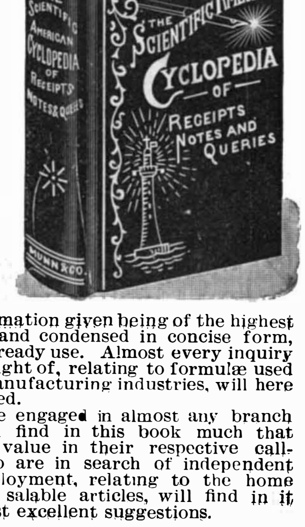

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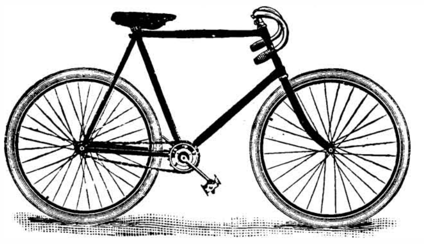

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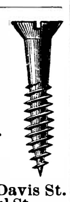

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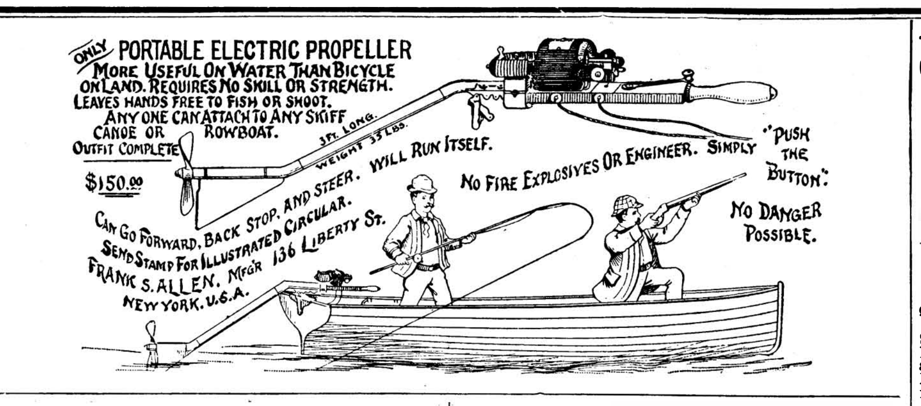

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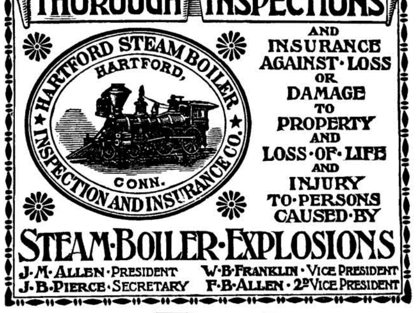

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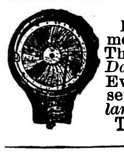

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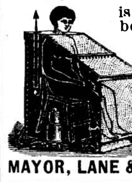

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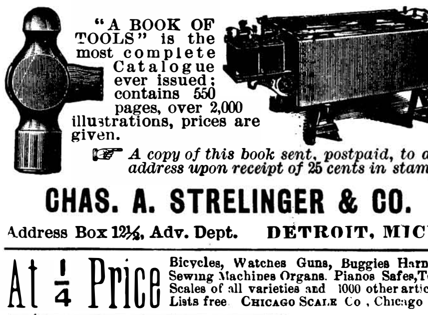

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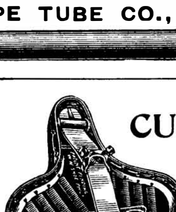

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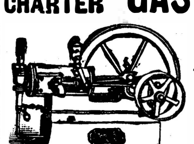

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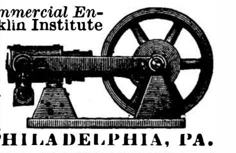

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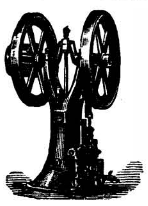

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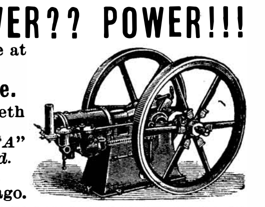

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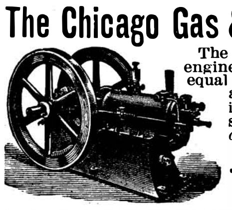

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