SCIENTIFIC AMERICAN

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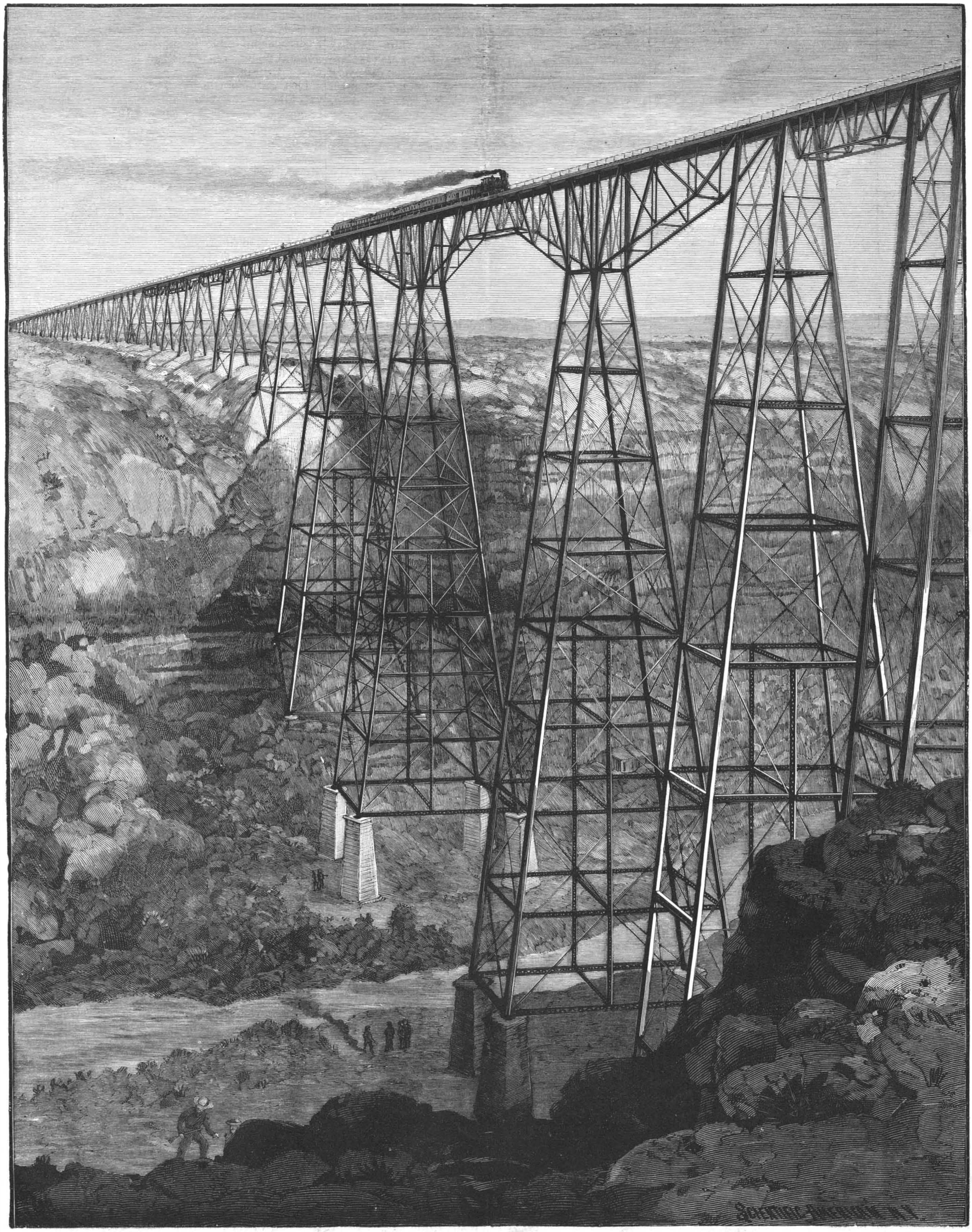

THE PECOS RIVER BRIDGE OF THE SOUTHERN PACIFIC RAILWAY.—[See page 87.]

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 893.

For the Week Ending February 11, 1893.

Price 10 cents. For sale by all newsdealers.

THE HAWAIIAN ISLANDS AND THEIR ANNEXATION.

Some two thousand miles from San Francisco in a southeasterly direction lies the group of the Hawaiian Islands, which have been the scene of the late revolution. The country is now in the hands of a provisional government who have deposed the queen, and the future disposal of the government is the question of the hour. Some advocate annexation to the United States. Great Britain would be hardly true to her nature did she not contemplate taking possession of the islands, so as to have one more stepping stone for the sun, which always shines on some part of her dominions. Germany's interest in the islands has not yet developed to any great extent.

About the year 1527 one or two Spanish ships were wrecked upon the islands, and the few survivors intermarried with the natives. Their descendants are identified to the present day by their light skin, liability to freckle, and by their facial contour, which is Caucasian. They are termed Kekea. The true discovery of the islands was effected in 1542 by Gaetano, a Spanish navigator, and in 1567 Mendana, another Spaniard, determined the true position of one of the islands, Kauai. In the beginning of 1778 Captain Cook visited the islands, whence his countrymen assign to him the honor of discovery. He left them and returned toward the end of the year. He excited the hostility of the natives and on February 14, 1779, was killed by them on the shores of Kealakeakua Bay, on the island of Hawaii. He was endeavoring to recover a stolen boat when killed. The name Sandwich Islands is derived from Lord Sandwich, of England, and was given by Captain Cook. Fortunately the beautiful native name, Hawaii, is now in the ascendancy and will, it is to be hoped, remain so.

A very elaborate system of feudal government originally obtained there, five or six independent monarchs holding sway. Wars were frequent. In one of them, in 1790, King Kamehameha was attacked by another king, and defeated the aggressor. He pursued his conquest and thirty years later was sole monarch of the

islands. The dynasty thus founded lasted until December 11, 1872. A chief, Lunalilo, was elected to succeed this house. On February 12, 1874, Kalakaua was elected king. He died in 1891, while visiting this country. His sister, the recent queen, Lilioukalani, the widow of John O. Dominis, the latter of American origin, succeeded him. She is the deposed ruler. Undoubtedly no native dynasty will again hold sway.

In the history of the country, which history is one tale of revolutions, some facts bearing on annexation may be noted. In 1810 Kamehameha I. wrote to George III. of England, desiring formally to acknowledge the British king as his sovereign and to place the islands under his protection. The offer, it is said, was accepted. Again, in 1843, a provisional cession of the islands to Great Britain is recorded, which was abrogated a few months later. By special treaty of 1889 the control of foreign relations was given to the United States.

The islands are twelve in number, with an area of 6,400 square miles, over three times that of the State of Delaware, or about four-fifths of that of the State of Massachusetts. One island, Hawaii, contains 4,000 square miles. Most of the rock formation is volcanic. On Hawaii are two active volcanoes—Kilauea and Mauna Loa. Between the effects of eruptions and accompanying earthquakes a number of lives have been lost. The highest point in the islands is Mauna Kea, on Hawaii, which rises to an elevation of 13,805 feet above the sea.

With such an immense range of altitudes, a great variety of climate can be secured. It varies from cool, frosty weather to very warm weather throughout the year. Sea breezes and northeast trade winds do much to temper excessive heat. In the winter heavy rainstorms occur, lasting sometimes for weeks.

The natives are supposed to be of the Malay race. At the time of Capt. Cook it is thought that the population was about 300,000. War and disease, the concomitants of civilization, have reduced the population, until the census of 1890 showed a total of 89,990, of which but 34,436 were of the aboriginal race. It is believed that they were originally cannibals. Except for this feature, they seem to have had many excellent features. Capt. Cook's death is believed to have been precipitated by his own cruelty and hypocrisy. The American whalers used to recruit their crews with Kanakas, as the natives were called, and tribute to their amiable qualities is easily found.

On April 4, 1820, seven American missionaries reached the island. Shortly before this time the natives had destroyed all their idols, and the missionaries found a nation without any religion. In 1825 the ten commandments were adopted as law by the government. The first missionaries reduced the language to a written form, with an alphabet of twelve letters *a, e, i, o, u, h, k, l, m, n, p, w*. Whether the limited alphabet has anything to do with it may be a matter of surmise, but the population is said to be on the average less illiterate than that of New York City or Pennsylvania. It is claimed that they have a well settled American society, comparable to anything in the States. The general feeling on the island is said to be opposed to Great Britain.

Last autumn the San Francisco *Examiner* had a poll taken of the Hawaiian parliament on the subject of annexation. The sentiment then was strongly in favor of independence. The queen's leaning toward absolutism is largely responsible for the revolution and presumable change of views of the leading men on annexation. Probably the sugar question is one of the factors at the bottom of it. At one time the sugar plantations paid a return of some fifty per cent on the investment. This state of things has been done away with by free West India sugar, so that a far smaller profit is made. The hopes of a bounty per ton of sugar is one element making the sugar planters anxious for annexation.

Practically Hawaii draws upon San Francisco for her supplies. In 1891 the tonnage of American ships entering the harbor of Honolulu was over three times that of English ships, or 173,891 tons. American imports aggregated $5,924,277, as against $1,201,329 of British imports. The sugar production is now 300,000,000 pounds per annum.

The leper colony on the island of Molokai, the scene of the heroic exertions of Father Damien, casts a shadow over a picture where there is so much that is fair. But Canada and Louisiana both have had lepers for many years; so in leprosy we would have no new acquaintance. Some thousands of miles to the south and east of Hawaii, Robert Louis Stevenson has established himself. But his lovely Samoa hardly yields to the charms of the more northerly group of Hawaii. The varied climate enables any form of vegetation to be raised that can be grown in a temperate or tropical climate. The establishment of a botanical garden, absolutely unique in the world's history, would be an interesting possibility. The islands are but six days from San Francisco, and by fast steamers could be brought much closer. Under proper conditions, they might attract and should attract many tourists. The fact that America is by far the nearest mainland seems to bring the islands within the operation of the Monroe doctrine, and goes to forbid the establishment there of a European power. The purchase of Alaska, under the advice of Seward, when United States Secretary of State, has proved an excellent operation for this government. The annexation of Hawaii, it may be believed, would prove in its degree equally good for us, and, it is to be hoped, would be good for the inhabitants also. As a touching point for ships, its value cannot be overestimated. In war the importance it would acquire, as a strategetical point, and as a depot for coal and supplies for war ships, is obvious. We already possess by treaty, rights in a species of harbor or coral lagoon, Pearl Harbor by name, which requires dredging before it will be available for ships of war. The bay of Honolulu, on the island of Oahu, is the principal harbor. It has 22½ feet of water. Good harbors among the islands are very few.

The islands now have a debt of $3,000,000. The necessary assumption of this debt is one of the principal reasons cited against annexation. It would virtually represent a price paid for the islands.

THE EDISON INCANDESCENT LAMP PATENT ATTACKED.

History repeats itself. Some years ago the great Bell telephone patent had arrayed against it a host of witnesses and able legal and expert talent. In the depths of Pennsylvania had been discovered an inventor who, it was held, had invented and had in operation a telephone and microphone antedating Bell and Hughes by many years. The case went to trial and one of the largest records ever produced in a lawsuit accumulated, and was produced before the Circuit Court in this city. The usual course was taken after an adverse decision in the lower court, but the appeal was without result. It was chiefly remarkable for the division of opinion of the United States Supreme Court. The Drawbaugh case to which we allude is a thing of the past. The expiration of the Bell patent in any case would relegate it to obscurity.

Now the electric light has found its Drawbaugh. Heinrich Goebel, born near Hanover in Germany, is the inventor cited to destroy the recently affirmed

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Edison incandescent lamp patent. In Goebel's alleged inventions we find the exhausted glass receiver and the true filament of carbon. It is not a rod or segment of pencil lead but a true filament of Edison's favorite bamboo. Starr's early lamp, it will be remembered, was based on a rod of carbon. The distinctive feature of Edison's invention is the thin high resistance filament.

Goebel was engaged in work upon apparatus for the Technological School of Hanover. His attention was there called to the Starr lamp. He emigrated to America and started as a dealer in clocks in this city. He experimented with electricity. He produced a repetition of Sir Humphry Davy's arc light upon the roof of his residence. The exhibition of so powerful a light occasioned an alarm of fire and the inventor was, it is said, charged before a magistrate with breach of the peace.

He then turned his work in the direction of Starr's invention. He experimented with the incandescent lamp. From experiments with such material as a bit of a carbonized umbrella stick, he progressed through the list of various wood fibers, until he tried a fiber from the bamboo stem of a pipe. Like Edison, he found that bamboo answered the purpose admirably. He made a number of lamps as early as the year 1855. A number of what purport to be these identical lamps are produced at the trial now in progress.

The lamp chambers are of glass tubing. Leading-in wires of copper, platinum and iron are used. The fiber, there is no doubt, is what it purports to be. The leading-in wires enter the base of the chamber. The ends are wound into spirals and retain within their convolutions the ends of the filament. To make a good joint in some lamps a carbonaceous cement has been used. It is claimed that it was made from Dixon's stove polish. In other lamps the joint was made by electroplating with copper. In some lamps a straight filament was used, one leading-in wire reaching nearly to the top of the chamber. In others a spiral filament and in some the familiar horse-shoe shaped filament is seen. The last shape the inventor called the hairpin pattern.

The vacuum was the strict Torricellian vacuum. The lamp, after introduction of the filament, was sealed to the top of a glass tube over 30 inches in length. The whole was filled with mercury, and set up, open end down, with the lamp on top. Thus it constituted a barometer. The mercury descending to the height of the barometric column produced the Torricellian vacuum in the chamber. The chamber was then sealed by the blowpipe flame and melted off from the barometer tube.

In these early days Goebel is said to have frequently exhibited his lamps. He used to set them in operation on his show case. He left his shop in 1874. He used to exhibit a 12 inch aperture telescope which was carried on a wagon about the streets. He used to show his lamps from the wagon to attract attention. A battery was taken as part of the outfit. These street exhibitions go back of 1860, so it is alleged.

His imperfect knowledge of the English language and his limited association with the world are cited as reasons for the obscurity of his work and for his not pressing his claims. It is also doubtful if, assuming all the allegations to be true, a patent could have been secured by him after the repeated public exhibitions. There was less inducement to patent it at the first dates cited, because there was then no dynamo invented available for cheap production of the current.

Such is an abstract of the story presented. If he fares but a degree better than Drawbaugh, the humble German inventor may carry with him the whole body of the court of last resort, and may destroy the Edison rights to the filament of carbon of the modern incandescent lamp.

Trial of an American Armor Plate at Portsmouth, England.

A Harvey nickel steel armor plate, 6 inches thick, was tested on board the Nettle at Portsmouth on the 17th ult. The 6 inch breech loading gun was used, firing Holtzer's forged steel projectiles weighing 100 pounds each. The trial was of a very unusual kind, the gun and projectile being those regularly employed for testing 10½ inch plates, except, indeed, that for two out of the five rounds constituting the usual test, Palliser chilled iron shot are used, whereas in this case four rounds were fired with Holtzer projectiles. It was out of the question to attack this plate with the usual charge and striking velocity, and the following order was observed: Round 1 was fired with a charge, we believe, of 30 pounds; at all events, the striking velocity was 1,507 feet per second. The projectile was pulverized without cracking or seriously injuring the plate. Round No. 2 was fired with, we believe, 42 pounds of powder. The striking velocity was 1,813 feet per second. The shot was again broken up, but the plate was cracked. No. 3 round was fired, we believe, with 48 pounds of powder. The striking velocity was 1,960 feet per second. The projectile perforated the plate and was lodged in the form of fragments in the backing. No. 4 round was fired with the charge again reduced, so as to give a striking velocity of 1,815 feet per second. The shell was again broken up without perforation, and no further cracks were made, and no part of the plate fell off from the backing.

This is a most remarkable trial, says the *Engineer*, for it must be borne in mind that the resisting power of a plate is more nearly as the square of its thickness than as the first power, so that for a 6 inch plate to break up a projectile which until recently was a match for 10½ inches is a great triumph, and it may be seen from the account that any structure behind the backing would have been protected. Attention must be called to the fact that while the shot was broken up at 1,815 feet velocity in such a way that a great part of its striking energy must have fallen harmlessly on the plate, it cannot be argued, on the other hand, that a shot is only capable of delivering a fixed quantity of energy before fracture, and that all energy over and above that is lost, for it appears that at 1,960 feet velocity much more injury was done, because we suppose more energy was delivered before the work of fracture was complete. Probably the fracture of the projectile occupies such a period of time that more work is done on the plate by increasing the velocity, because, although the shot is the weakest element, there is not time to find the line of least resistance before additional injury is done to the plate. It is perhaps the same action as causes fulminate not to follow the lines of least resistance taken by slower powder in bursting a vessel.

Thermal Storage.

In the course of a recent lecture at the Society of Arts, London, Professor Unwin made the first public mention of a very important invention known for some time to a few, and likely to have a bearing, so *The Engineer* says, on the economic generation of electricity, whether in large or in small installations. It is the invention of Mr. Druitt Halpin, and consists in the storage of the continuous thermal work of one or a small number of boilers to do the work of several or a large number of boilers for short periods. That is to say, that he meets the difficulties which bring about a low load factor, and with an ordinary load diagram he is able to meet the varied demand on the part of engines and generators, with a uniform or straight line load diagram as concerns the boilers. His system is one which is equally applicable for continuous and for alternating current stations, and in many cases it will make secondary batteries unnecessary, except in very small numbers. We shall not now enter into a full description of Mr. Halpin's system, but we may briefly describe it as follows: At the present time it is necessary in electric generating stations to provide sufficient boiler power to meet the maximum demand, or the highest part of the load diagram. This only, even if we make its mean, represents about one-sixth to one-fourth of the twenty-four hours; yet boilers must be provided, and fires either lighted up or banked up to meet this short period, the boilers themselves being sufficient to meet the maximum demand continuously.

This not only enormously increases the fuel consumption, but it makes capital expenditure high, and the unit cost of current very much higher than if produced with boilers always working at full load. To avoid these difficulties and losses, Mr. Halpin, under this thermal storage system, employs boiler power of from about one-sixth to one-fourth the maximum load. These boilers he works continuously at their best and most economical rate of evaporation. During those of the twenty-four hours when the generating station demand is small, the thermal work of these boilers is stored by passing the water which they heat into a sufficient number of plain storage tanks, protected from loss by radiation or conduction. The boilers which he employs will work at a pressure of say 250 pounds on the square inch, and will be what we may call flooded boilers; that is to say, there will be no steam space within them. The storage tanks will, of course, also be worked at this pressure, but by very well known arrangements steam will be taken from them when the engines are working at a pressure of say 130 pounds. During the time of maximum load the water level in these tanks will fall by conversion of heated water into steam, and the level will again be made up during the fall to minimum demand. The storage tanks will be the equivalent of the gasholders in a gas supply system, and in number will be sufficient to give a capacity of about 14 pounds of water per pound of steam required during the period of demand which is above the mean load. The estimated cost of this arrangement is less than that for a sufficient number of boilers, and a saving on the present cost of steam production in some of the well known generating stations will, it is said, probably be from 40 to 50 per cent, so great is the loss of fuel during the time when boilers are under fire with closed stop valves.

Mr. Halpin's system has never been employed in electric work, but the enormous cost of fuel per electric unit under existing circumstances, as compared with the easily practically possible 2¾ pounds of coal per unit, shows how much it is wanted, and how completely it has escaped all previous inventors. Yet the principle upon which it is based is old, and has received various applications. It is another of that important class of inventions which employs old means in new combinations and applications to the public benefit.

Half-tone Etching on Copper for Typographic Blocks.

A contributor to the *Photographic Times* says:

Copper, being tougher and harder than zinc, makes a particularly good metal for type press work. It will stand double the number of impressions, and show no wear whatever. Besides, the results are finer and better in every way. Inasmuch as nitric acid is not a useful mordant for copper, entirely different methods of procedure are necessary.

It has long been known that bitumen contained properties of being sensitive to light, and this article will form our sensitizing mixture. The formula below for preparing the bitumen is to *increase* its sensitiveness, which in this age of haste and "do-things-quickly" is an essential.

Dissolve 7 to 10 grammes of sulphur in a sufficient quantity of carbon bisulphide, and then add 100 grammes bitumen. The solution is then freed from carbon, and placed in a drying stove, in which the temperature is gradually raised to 356° F., until the odor of sulphureted hydrogen disappears, which requires about five hours. The bitumen, after this treatment, shows itself in the form of a black mass, brilliant, insoluble in alcohol, but equally soluble in benzine, turpentine, etc. Four parts of this bitumen are dissolved in 100 parts of benzole, which forms the sensitizing mixture.

The copper plate, having been polished with charcoal (which is made for this purpose), is dried, then coated with the bitumen solution, using a whirler to distribute it evenly over the plate. It is now placed in contact with the negative, exposed in bright sunlight for ten minutes, developed in a bath of turpentine in the dark room. The turpentine dissolves all the coating that has been protected from the light, leaving the image clean and clear.

The plate may now be touched up, using a fine brush, and the sensitizing mixture placed in the light for a time, when, after painting the back with shellac, it is ready for etching. One ounce of a saturated solution of perchloride of iron is added to four ounces of water, and the plate is placed in this solution, using a glass or porcelain tray. The biting commences immediately, and is to be continued until a sufficient depth is reached, which can be judged by scraping through the coating on the margin, and when the fingernail catches against the edge it is deep enough. It should be about the depth of the thickness of a tin plate.

This plate should be brushed during etching to aid the solution in getting at the metal, using a soft camel-hair brush. The plate is now ready for mounting, routing, or sawing away the edge, and nailing to a block of mahogany of a thickness to make the whole just type high.

Copper is being extensively used now, and half-tones on this metal command a higher price in the market than zinc work. This process is very simple, and gives excellent results.

A High Temperature Furnace.

M. Henri Moissan has contributed to the *Comptes Rendus* an interesting report upon his experiments with furnaces worked at extremely high temperatures. He observes that the highest temperature attainable by coal gas and an oxygen blast is about 2,000° C., at which no crucible other than one made of quicklime will stand. Having had occasion to submit substances to a still higher temperature than 2,000° C., M. Moissan thought of using the heat yielded by the electric arc, and to this end he planned an arrangement which has at least the merit of extreme simplicity. The furnace is formed of two bricks of quicklime, carefully cut out and placed one above the other, the lower brick having a longitudinal groove in it to receive the two electrodes, and a small cavity in the middle which serves for a crucible. This contains the substance to be ignited. In the first experiments, a small Edison dynamo driven by a gas engine was used, and with a current of 30 amperes and 55 volts a temperature of not much exceeding 2,250° C. was attained. Ultimately a force of 50 horse power was used, and the temperature of 3,000° C. was reached. Great care was necessary, in the experiments, to avoid injury to the eyes and the face by exposure to the fierce heat. Some remarkable results were obtained by employing these high temperatures. At 2,500° C., lime, strontia, and magnesia crystallize in a few minutes. If the temperature reaches 3,000° C., the material of which the crucible is composed (quicklime) melts, and runs like water. At the same temperature, carbon quickly reduces calcium oxide, and the metal is liberated in abundance. Some very fine crystals of the borides and silicides can also be obtained in this way, and many substances exhibit very striking reactions. M. Moissan is continuing his researches, and he promises to publish his further results.

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THE MONEY MAKER.

For months past a familiar sight on Broadway has been the toy vender who sells the little machine called the "Money Maker," the machine consisting of a pair of rollers, in one side of which are inserted plain sheets of paper, of the size of a bank note, and as the rollers revolve, a bright new bill rolls out from the opposite side, then another blank sheet is inserted and another bill rolls out, and so on. To the uninitiated this operation is a mystery, and to the unprincipled it is apparently the device long looked for. This machine is certainly as good as any device calculated to make something out of nothing, but in this, as in other things, what you get you must pay for.

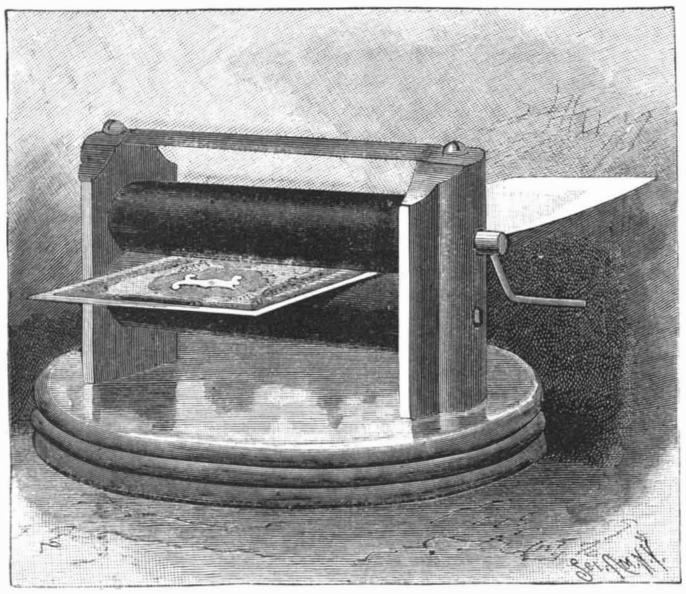


Fig. 1.—THE MONEY MAKER.

The explanation of the device is made simple by the enlarged cross section. To the two rollers journaled in the standards are attached the ends of a strip of black cloth, which is wound around both rollers in opposite directions, so as to about evenly divide the cloth between the rollers. The gudgeons of the rollers are squared to receive an ordinary clock key, by means of which either may be turned. To prepare the machine for operation, the cloth is wound upon one of the rollers while it is partly unwound from the other; then the key is transferred to the gudgeon of the partly filled roller, and as it is turned, crisp new bank bills are fed into the machine and are wrapped with the black cloth upon the roller between the convolutions of the cloth; one bill after another is thus inserted until three, four or more bills are hidden in the roll and the rollers present about the same appearance as to size. This preparation, of course, takes place aside, and is not seen by the persons to whom the trick is to be shown. The key is shifted from the roller containing the bills (the upper one in the present case) to the lower one. Now, as the lower roller is turned so as to unwind the cloth from the upper roll, a piece of plain paper of the width and length of a bank note is inserted at the moment the first bill is about to emerge from the layers of cloth on the upper roll. The paper begins to be rolled upon the lower roll under the outer layer of cloth, so that while the paper appears to be simply rolled through between the rollers, coming out upon the opposite side a complete bill, it is in reality only hidden by the cloth on the lower roller. After the first bill is discharged from the rollers another piece of paper must be supplied in such a manner that it will begin to enter the machine as the next bill emerges, and so on.

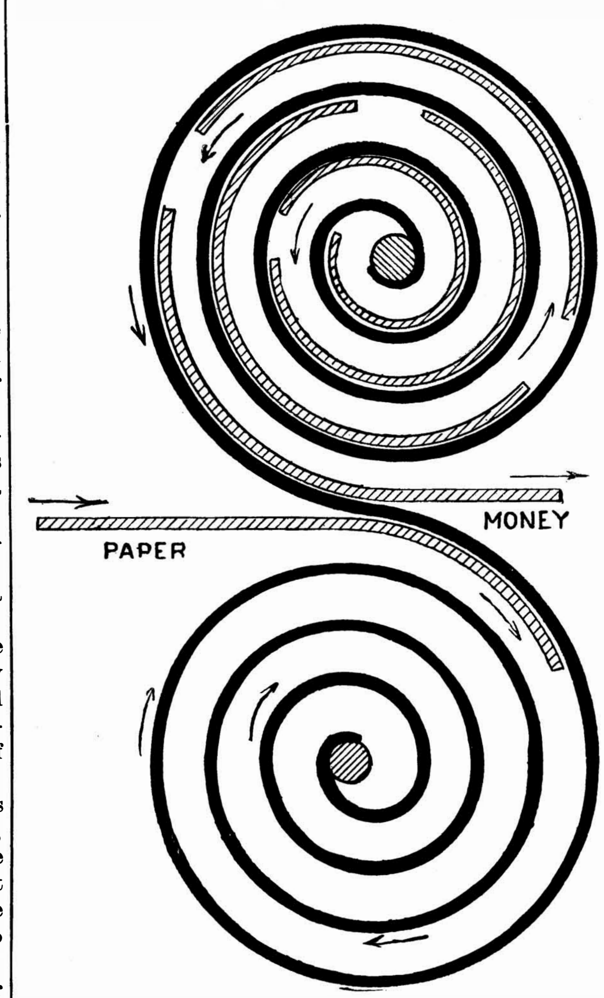


Fig. 2.—CROSS SECTION OF THE MONEY MAKER.

THE molecules of ice are bound together by a very great force. To separate them, that is to melt say one pound of ice at 32° F., requires a power of 109,396 foot pounds, or a power equal to lifting the ice to a height of over twenty miles, or the exertion for one minute of over three horse power.

Foreign Commerce of the United States.

According to the report of the Bureau of Statistics, the value of our imports of merchandise for the calendar year 1892 was $876,198,179, an increase of $47,877,236 over the value of the imports for the calendar year 1891. The average annual value of our imports for the ten calendar years from 1882 to 1891, inclusive, was $730,009,046. It will thus be seen that the value of our imports for the calendar year 1892 exceeded the annual average value of imports for the ten preceding calendar years by the sum of $146,189,133.

The increase in the value of articles and classes of articles of merchandise imported during 1892, stated in the order of magnitude of value, was principally in coffee, caused largely by increase in price, cane sugar, wool and manufactures of, leaf tobacco, and raw silk. There was a decrease in the value of imports of beet sugar, iron and steel and manufactures of, textile grasses and other vegetable substances, and vegetables.

The total value of our exports of merchandise during the calendar year 1892 was $938,419,893, as against $970,509,646 in 1891, a decrease of $32,089,753.

The value of our exports of domestic merchandise was, during the calendar year 1892, $923,226,312, as against $957,333,551 in 1891, a decrease of $34,107,239.

There was a marked decrease in the value of exports of raw cotton, caused largely by the decline in price, and in copper, refined sugar, manufactures of iron and steel, manufactures of leather, and manufactures of wood.

The total value of our imports and exports for the calendar year 1892 was $1,814,618,072, an increase of $25,787,483 over the total value of our foreign commerce of 1891, when it amounted to $1,798,830,589. The average annual value of our foreign commerce for the ten years from 1882 to 1891, inclusive, was $1,524,692,025.

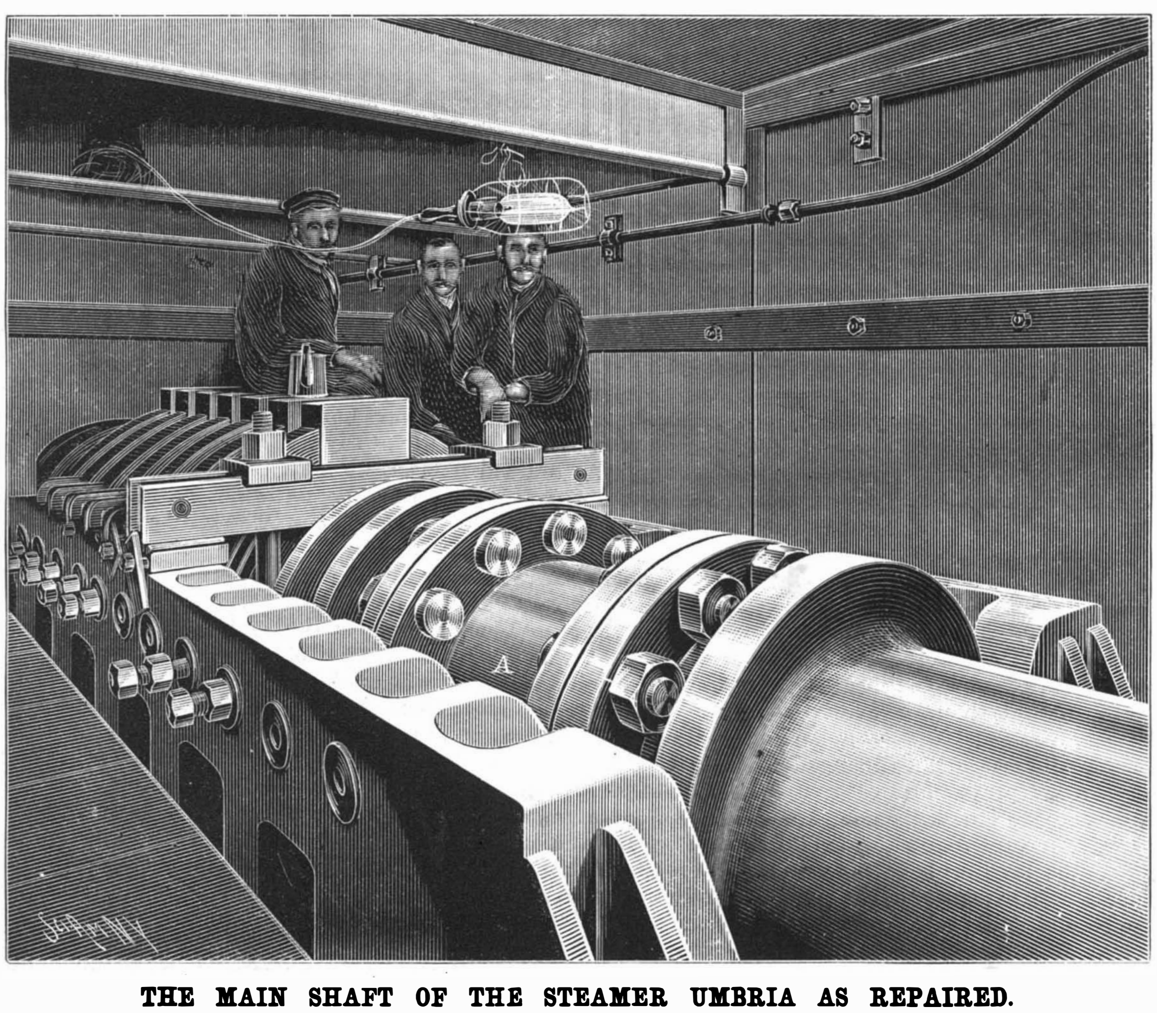
The value of our foreign commerce for the calendar year 1891 exceeded the annual average value for the ten preceding years by $289,926,047.

THE MAIN SHAFT OF THE STEAMER UMBRIA AS REPAIRED.

In our number for January 28 we gave several illustrations showing the mode of repairing the main shaft of the Cunard steamer Umbria, which, it will be remembered, broke down at sea December 23 last, and was temporarily mended, thus enabling the ship to reach the port of New York. A more permanent repair was here undertaken, which consisted in drilling out the broken section of the shaft, setting in a new section, and securing the same in place by means of nuts and bolts, which passed through the thrust collars of the shaft and the collars of the new section. These repairs occupied about thirty days' time.

The appearance of the main shaft as thus finally repaired, and of the newly inserted section, are shown in the accompanying engraving, which is from a photograph taken just before the ship sailed for England. A indicates the newly inserted section of the shaft.

The Umbria left this port on her homeward voyage on the 26th of January, and safely reached the Mersey February 4, showing that the job of repairs was a good one. At Liverpool a new main shaft is to be put in and the ship put in order for the coming summer passenger traffic, which it is expected will be very large, in view of the World's Columbian Exposition that opens in May next.



THE MAIN SHAFT OF THE STEAMER UMBRIA AS REPAIRED.

Metal Sleepers for Railways.

In a report on steel sleepers contributed to the International Railway Congress at St. Petersburg, M. Kowalski states that about 10·3 per cent of the total railway mileage of the globe is carried on metal sleepers. He finds that on about 4,600 miles of line, of which 180 miles were laid with steel sleepers, the maintenance of way of the latter was 30 per cent less than that of the rest of the line. According to another estimate, with metal sleepers the saving in cost of maintenance is 12 per cent for the first year they were laid, and rises to 40 per cent in the third year. There is also a considerable saving in replacing sleepers, as the life of a wooden sleeper is put down at 15 years, as against 30 for the metal one. Taking first cost only into account, M. Bucha estimates that to pay the metal sleeper ought not to cost more than 1·63 times the wooden one; and this estimate is confirmed by M. Asser, engineer-in-chief of the Dutch railways. If, however, the reduction in cost of maintenance and renewals is also considered, M. Kowalski concludes that a metal sleeper may have a first cost twice that of the wooden, and still show a large saving.

COMMODORE FOLGER, Chief of the United States Naval Ordnance Bureau, is reported to favor the construction of a 16 inch gun, 511½ inches in length, weighing 246,800 pounds, and capable of throwing a missile weighing a ton 16 miles. The cost would be about $120,500.

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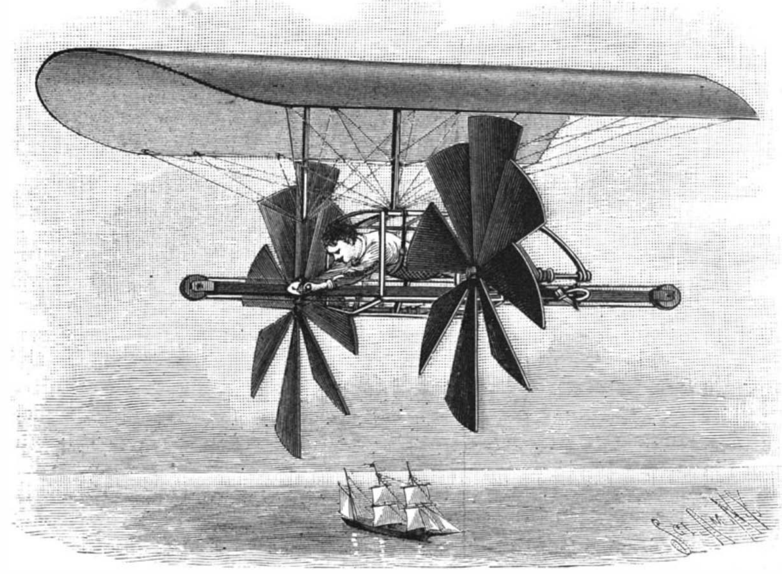
A LIGHT AND SIMPLE MOTOR.

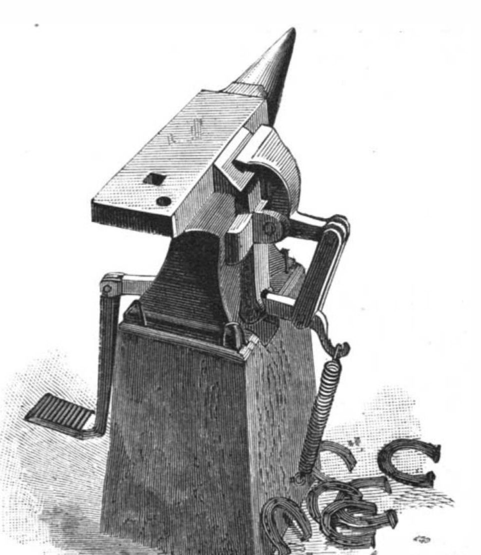
A motor to be operated by the hands and feet, which may be used for driving flying machines and other purposes, and is designed to bring into play all the muscles of the body, is shown in the accompanying illustration, and has been patented by Mr. Theodore A. Stark, of Ottawa, Ill. In use for a flying machine, as shown, the motor is provided with a light open frame having an open central space large enough to receive the body, the frame being suspended from an aeroplane, which may or may not be inflated. The motor consists of a straight hollow bar, with a central slot for a driving shaft and pulley, an endless belt wound once or twice around the pulley running also over pulleys journaled in forks at the ends of the bar, the forks being adjustable to give the proper tension to the belt. On the bar near its ends are slides, one to be moved by the hands and the other by the feet, and the slides have on each side projecting grooved abutments through which passes the driving belt, a swinging leaf or link being so arranged in each abutment that when the slide is pulled in one direction the leaf on one side will permit the slide to move freely along the belt, but when moved in the other direction the leaf binds the belt in the abutment, and the movement of the slide is imparted to the belt. In side extensions of the frame are journaled propelling wheels, whose hubs have grooved pulleys connected by a belt with the driving pulley, whereby the motor is operated as a flying machine, the propeller blades being arranged at such angle that they will lift upward on the machine, and also move it forward.



STARK'S MOTOR FOR FLYING MACHINES, ETC.

A HORSESHOE SHARPENING APPLIANCE.

A novel anvil attachment designed to facilitate the sharpening of horseshoes is shown in the accompanying illustration, and has been patented by Mr. Jerome W. Rapp, of Pineville, Pa. A vertically adjustable keeper is fastened to the front of the anvil by a bolt passed through a slot, and on the face of the keeper are teeth engaged by teeth on a shank which carries at its upper end a die at the side of and at an angle to the top or face of the angle, the same bolt also fastening the shank in place on the keeper. On the sides of



RAPP'S HORSESHOE SHARPENER.

the shank are lugs carrying a pivot for a lever which has an upper curved end extending opposite the die, the lower end of the lever being connected by a link with a pivoted lever passing through a slot in the foundation, and having at its end a downward extension and footpiece. The clamping lever is normally held away from the die by a spring, until the operator presses upon the foot piece, after the shoe has been placed in position to sharpen the calks. With this construction the operator has both hands free to manipulate and work on the shoe, which is held securely in place on the anvil by simple pressure on the foot piece.

Cold Storage for Silks.

The cold storage of furs and woolens as a preventive against moths is now quite familiar to the public, but the cold storage of silks is, we apprehend, a new suggestion for which the trade has to thank the observing New Yorkers. The theory and practice are thus described by a recent writer:

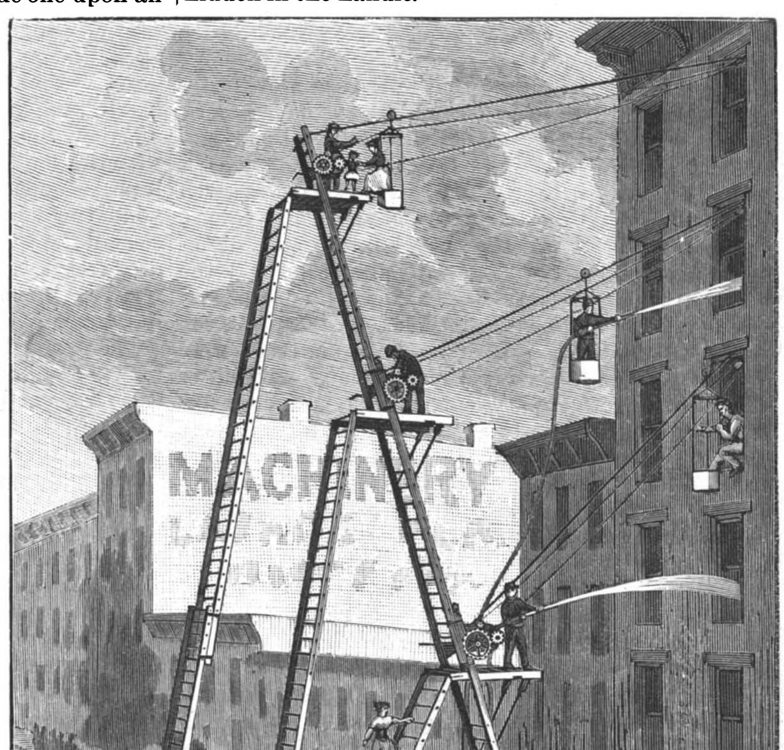
"Raw silk is sold by weight, and when stored in ordinary warehouses the silk dries and naturally decreases in value. By storing it in a cold vault the moisture is preserved and the silk keeps its weight. There is another curious fact in regard to the cold storage of silk. Many large dealers in silks and ribbons keep their bales and bolts in cold storage with the temperature reduced below the freezing point. It was discovered some years ago that silk in winter usually had a finer luster than in summer. The cold air was supposed to be accountable for the change, and an experiment was tried in keeping bales of silk in cold rooms for comparison with others on the store counters.

"The cold silk then appeared to be of a much finer quality, when in reality it was from the same loom. As soon as this fact became generally recognized the large silk dealers went to the cold storage warehouses and had their silks placed in freezing vaults. In some cases the thermometer is kept as low as 10°, and when the bales are taken out they feel like blocks of ice. Some firms keep most of their stock in storage, and only take silk out in quantities equal to the anticipated sales of the day, for the luster acquired by freezing soon disappears after exposure on the bargain counter. It is asserted that an inferior grade of silk while extremely cold has the feeling and appearance of a much higher grade which has not been frozen; while, on the other hand, it has been found that the best grades are not improved by the arctic treatment."

AN IMPROVED FIRE APPARATUS.

The accompanying illustration represents a combined fire escape and fire extinguisher patented by Mr. M. A. Pauly, of Eau Claire, Wis. It is designed to be raised in the center of the street, so that the firemen may work over telegraph and other wires strung on poles, and is provided with insulated shears for cutting all kinds of interfering wires. The apparatus is carried by a frame upon a wagon body, the wheels being mounted to make short turns. At one end of the body is a shaft to which is secured the lower section of an extensible ladder whose sections slide one upon another. The lower ladder section is raised to the desired angle by means of a bowed rack bar, acted upon through a crank and connected gearing, and at the top of each ladder section except the top one is an arrangement of cables and pulleys whereby a crankshaft may be worked at the top of one section to raise the next section, and so on until all the sections are raised. Near the top of each ladder section is a swinging platform, connected with which are detachable ladders, bracing the main ladder and connecting it with the ground, to facilitate the carrying up of hose and afford further means of escape. In the upper end of each ladder section is a drum carrying a strong rope adapted to serve as a track for a life car, one end of the rope to be thrown to a window in the building, where it is to be made fast, when the drum is turned to take up any slack. Beneath this drum is another on which is the carrying rope for a life car, the arrangement being such that by turning the drum the car will be moved quickly backward and forward to convey people from the building to the landing. The car is also supplied with a small rope with which a fireman may raise a line of hose, to direct a stream upon the building from the car. When not in use the sections are run down to make the ladder as short as possible, and so that all will lie horizontally on the frame.

The apparatus being placed in position the gears upon the frame are turned to actuate the rack bar, raising the sections to the desired angle, when a fireman goes up the first section, cuts interfering wires, and runs up section two to its position, swinging the platform of the first section horizontally, adjusting its front standards, and fastening the back short ladder to the back end of the beams of the platform. A small rope tied to a hook and pulley at the loose end of the life lines is then thrown to a window in the building, where the hook is placed in a ring in the window casing or ceiling, after which the life lines are adjusted to the proper tension, and the fireman begins to operate the gears above the platform to move the car back and forth. Another fireman, in the meantime, runs up the third section, and in a similar manner adjusts its platform and back ladder, and makes the life line connection. To overcome any liability to sag back of the section being raised, a triangular arm ending with a gear wheel runs in a rack bar in the outside of each side frame of a section, being firmly fastened to the outside of the side frames near the top of the stationary section. The platforms are designed to be sufficiently strong to prevent the sectional ladders from being pulled forward or sagging backward.



PAULY'S FIRE APPARATUS.

Anticholerin of Klebs.

Professor Klebs, reasoning that every organism during its lifetime produced substances which if allowed to accumulate would result in the death of such organism (in the case of man and animals these products are carbonic oxide, bile, urine, etc.), has realized success in the treatment of tuberculosis by a preparation, "*tuberculocidin*," made from the cultures of the tuberculosis bacillus (*Am. Jour. Pharm.* 1891, 599); the failure of Koch's *tuberculin* is explainable by the presence of products which have specific toxic action upon man along with the products which are destructive to the bacilli; by removing the former substances (called alkaloids) a preparation is obtained not injurious to man, but fatal to the bacilli. *Anticholerin* is a preparation in which these reasonings are applied in the purification of an extract from the culture of the comma bacillus, and which has given very encouraging results in the treatment of cholera in a Hamburg hospital; while only the most serious cases were treated with it, the number of fatal cases was 16–17 per cent less than was the case with other treatment. The preparation is a clear, brown-yellow viscid liquid, having an odor reminding of cholera patients; it is injected into muscular tissue of the stomach, or into the subcutaneous tissue of the thigh. —*Dr. Manchot* (*D. Med. Wochenschr.*), *Pharm. Ztg.*, *1892, 719; Am. Jour. Pharm.*

THE newest walking-stick is verily a light unto his feet and a lamp unto his path—an electric light is hidden in the handle.

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The Glacial Period.

RALPH S. TARR.

It is not generally known, even among people well educated in lines non-geological, to what an extent we are indebted, as a people, to a certain accident or incident which occurred to a portion of the earth in times not very remote. If one will examine a map of New Jersey, he will find to the north of a line somewhat irregular, but extending from near New York to a point a few miles south of Delaware Water Gap, that there are many lakes, while south of this there are none. Moreover, if he is acquainted with the State, he will recall the fact that south of this line the streams flow uniformly in broad valleys with moderate slope, while north of it the valleys are sometimes narrow gorges, and the course is often marked by rapids and even falls. The same description holds true for the country on either side of this line continued northwestward to Dakota.

One who has traveled in the North and South can hardly have failed to notice this remarkable diversity in scenery, if he has traveled with his eyes open. Who would mistake the scenery of Maryland or of Virginia for that of New England? To be sure, the grander features of the topography in the two regions differ, because of difference inherent in the rock structure in large measure; but the details vary because of this accident. The gorges, the falls, the lakes, the pitted sandy plains, the grand knolls, and the lenticular drumlin hills which occur, for instance, in Boston Harbor and near Worcester, all these are found to the north of this line; but to the south of it they do not occur. This must not be accepted as strictly true, for all know that lakes do occur, that waterfalls and gorges are found south of this line; but they are rare, and are of different origin.

The line of which I have spoken is the terminal moraine on the southern limit of a great continental glacier that covered all the land north of it with an ice sheet, compared with which the inland ice of Greenland is small in extent and probably also slight in thickness. When this came, how long it remained, when it disappeared, and just what its exact history was we have not yet sufficient knowledge to state; but that it came upon a land which had previously been inhabited by plants and animals, and that it stayed a long time before disappearing we know to be facts, and can demonstrate to the satisfaction of even the most skeptical. Soils were removed and others put in their place, some valleys were deepened and hills lowered, other valleys were clogged with *debris* and the river turned aside or ponded back by dams of drift, and even hills had their form changed by the accumulation of drift upon their slopes and summits. Our excellent water power of New England was made possible, in large part, by the glacial changes, the strong though rocky soil of the same region was given it by the ice, the scenery was modified by it, and even the harbors of that coast seem, possibly, to have been the indirect result of the presence of the glacier.

It was very early noticed that in Europe and Northern America there were accumulations of bowlders, gravel, sand, and clay, sometimes stratified as if laid down in water, sometimes totally unstratified as if merely dumped there; and to this material was given the name drift. Certain deposits in southern regions, chiefly near rivers, which we now know to be of different character, were classed with the drift, and the whole mass was ascribed to the Noahcian deluge and was pointed to as proof of this deluge in answer to the criticisms of biblical skeptics. As the materials were studied, however, they presented many difficulties which the more acute students could not account for. It was noticed, for instance, that the bed rock was often scratched and grooved, and that these scratches were uniform in a given region, and even over as large an area as New England that the grooves pursued a nearly uniform northerly and southerly direction, though varying slightly from place to place. Large bowlders of rocks, of granite, for instance, were found stranded upon rock of an entirely different character and without a granite outcrop often in many miles. Studying this phenomenon, it was found that if one went in a northerly direction, toward the point to which the glacial scratches extended, an outcrop of this rock could usually be found. Little by little it became apparent that these bowlders came from the north, and a study proved that this was so. It was then found that one could trace these bowlders to their source, and that from knobs of rock there were southerly extending trails, which in the case of certain distinctly marked rocks were easily followed.

That floods of water unaided could transport great blocks of rock, often weighing scores of tons, in some cases many miles from their source, seemed improbable, particularly since many of the deposits of drift were not stratified, but consisted of fine clay and bowlders indiscriminately mixed, plainly showing that they were not assorted by water. Violent currents were assumed by some, but the view most commonly accepted was that these currents carried with them icebergs which buoyed up the blocks of stone and carried much drift, which, when they were stranded, fell down without being assorted. It was, it is true, necessary to assume currents with remarkable uniformity of direction; but since no other explanation offered itself, this seemed a necessary assumption. There was, however, one fact which, more than all others, made the theory weak, and this was that large bowlders were often found upon hill tops, to which they were borne from a much lower region. It was not noticed then that there was a line quite distinct in character, south of which the glacial drift does not occur, and that this line is not a height of land, but varies, sometimes crossing the plains, sometimes the mountains. Had they noticed this, they must have given up the theory, for surely no flood could occur which would cover hilly New England and the Highlands of New Jersey but fail to pass over the arbitrary line often to much lower land.

While these difficulties were puzzling many geologists, Louis Agassiz came to America and with his wonderful perception saw that the drift deposits and the glacial phenomena of New England were an almost exact repetition of the phenomena in the valleys of the Alps below the glaciers which had once been occupied by ice, and he saw that, since the facts were the same, the explanation was probably the same. Since he published his views there has been a careful study made of the whole problem, facts have been accumulated with great care, and all point to the truth of his theory, until now it is supported by overwhelming testimony.

The ice front stood, as has been said, in an irregular line, extending from Dakota through Wisconsin, Ohio, Southern New York, Northwestern Pennsylvania, Central New Jersey, and south of New England at Long Island, Martha's Vineyard, and Nantucket. Its extension seaward east of New England is not known; but it stood somewhere in the sea, probably discharging icebergs, just as does the Greenland glacier to-day.

The land north of this line was ice-clad. A great plateau of ice covered all the country and buried even the highest peaks. We know this because glacial striations are found on the high peaks, such as Wachusett in Massachusetts and Monadnock in New Hampshire, while even upon Mount Washington transported blocks of rock are found well up toward the summit.

This is what we know about its existence. Unfortunately we cannot say with equal definiteness why it came nor why it went. That there has been a change of climate is certain, but why? It is not difficult to suggest plausible reasons, but it is very difficult to say that this or that one is the true cause, or even that it is an efficient cause. Any part of the earth can be transformed into an ice-covered waste, provided the climate can be made sufficiently cold and the rainfall transformed to snow. In tropical regions this can be done by elevation, and Kilima-Njaro nearly under the equator rises above the snow line at 16,000 feet above sea level, while in Spitzbergen and in Greenland the snow line is at sea level.

If we could raise the northern part of America and Europe a thousand feet, the region of perpetual snow would be moved much farther south than now. It must be borne in mind that there is no necessity of making the line of snow, which is the place where snow remains unmelted throughout the year, coincide with the limit of the ice; for where snow accumulates it presses out by some path of escape and extends beyond the line of perpetual snow, as in the valley glaciers of the Alps, where their terminus is several hundred feet below the snow line. So in the case of the great continental ice sheet the snow line may have been in Canada while the ice front was in New England.

There is evidence enough that the continent was higher in times preceding the glacial incursion than it is now, but I cannot go into this in detail. This evidence is, briefly, that there are many valleys evidently river formed which are now partly or entirely submerged, such, for instance, as the Saguenay of Canada and the many fjords and bays and harbors of our eastern coast. It was for this reason that I said, in the first part of the article, that the harbors of our east coast were perhaps the indirect result of the glacier, for there are some who suppose that the accumulation of the ice was so great that the earth's crust was pressed down and once elevated land submerged. I would not care to insist that this former elevation was the cause of the glacial period, though it seems probable that it was at least a part cause.

(*To be continued.*)

Photography on Wood According to the Method of Lalleman.

The surface of the wood, and that only, is imbued with a solution of alum and allowed to dry spontaneously or at a gentle heat. The entire block is then coated with a mixture of animal soap, gelatine, and alum. We have used the following compound:

Water	100 parts.
White soap (castile)	2 "
Gelatine	2 to 3 "
Alum	1 part.

The solution should be used warm. When dry, the surface which is to receive the image is placed for a minute or two in a solution of hydrochlorate of ammonia (chloride of ammonium 2:100), and again allowed to dry. It is then sensitized with a bath of nitrate of silver 1:5 and dried in the dark. A negative either on glass or on paper is then applied on the surface of the wood in a pressure frame made for that purpose, which allows the progress of the printing to be watched. The image is fixed in a strong solution of hyposulphite of soda, and then washed for five minutes only.

The sizing protects the wood from any moisture, and an eight months' experience has proved that the use of alum, instead of loosening the texture of the wood, gives it a great toughness which is favorable to the engraving.

The Arrowroot Plantations of Coomera and Pimpama, Queensland.*

BY H. L. THOMPSON.

The arrowroot grown in the township of Coomera is the purple variety—the *Canna edulis.* It sometimes grows to a height of eight feet, bears a pretty scarlet flower and a dark purple seed pod follows, which is generally sterile. The best variety of arrowroot, the *Maranta arundinacea*, which is grown so extensively in the Bermudas, thrives well in this district, but its cultivation has been almost abandoned, owing to the difficulty of manufacture. This kind attains the height of two feet, and bears, at maturity, a small white flower somewhat resembling the potato blossom. In the districts of Coomera and Pimpama there are from 250 to 300 acres under cultivation.

The mode of cultivation is as follows: The ground is plowed in ridges of about forty-six feet wide, and thoroughly harrowed and scarified. Nine rows are placed in this, five feet apart, leaving six for the row in which the by-furrow comes. Shallow furrows, five inches deep, are run with the plow, then the smaller bulbs, about the size of a small apple, which are found growing at the bottom of the stems, are placed four feet six inches apart in the drill, and covered by turning a furrow from each side on to the top of the bulbs. Afterward, cultivation is carried on by keeping the ground clear of weeds by means of horse hoes or scufflers. When the plant reaches the height of about three feet, the space between the rows is turned up with a one horse plow, the soil thrown toward the plant, and a furrow left in the middle. It requires nothing further till it is dug up for the mill. When the tubers have come to maturity, which is generally in ten months or a year, the crop is ready. The stalks of the plant are then cut off as close as possible to the tubers with a cane knife or strong reaping hook. The tubers are then raised with grubbing hoe or mattock. With all speed they are placed in carts and conveyed to the mill, for the color is seriously affected by being exposed to the sun or weather before grinding. Sometimes as much as 50 pounds of tubers are obtained from one plant.

The machinery consists of a six horse power engine, a root washer, grinding mill, cylinder sieves for separating the farina from the fiber and pulp, and a centrifugal for drying. The root washer is a trough ten feet long, three feet deep, and two feet in diameter. This has a half circular bottom, through which a stream of water is constantly running. A spindle having pegs about four inches apart, and of a sufficient length to reach within an inch of the bottom and sides, revolves in the trough. The pegs cleanse the bulbs of all dirt and they gradually work down to one end of the trough. A wooden rake pushes the bulbs out into a continuous belt elevator, and thence they are conveyed to the hopper of the mill. This is a wooden drum two feet six inches on the face and two feet in diameter. It is covered with a sheet of galvanized iron, punched and placed on with the burr on the outside. The drum revolves at great speed, and a stream of water falls on it from tanks fixed above. Thus the bulbs are grated up, the bulbs and the water passing through the sieve No. 1, which is a cylinder eight feet long with the bottom half perforated with holes about the size of a No. 7 wire nail. Within this a beater revolves, forcing the water and farina through the holes, and being placed on the screw the pulp and fiber are forced out at the end. The farina and water pass into sieve No. 2, which is similar to No. 1, only with holes about the size of a large pin head in the bottom of copper. After this the liquid runs along a trough two feet wide, six inches deep and seventy feet long. The farina is deposited at the bottom of this, and the water passes off. The farina is now dug out, and passed through sundry more sieves, washed by hand and in tubs, then finally left to subside. When pretty firm it is taken out and passed through a centrifugal machine. It is now placed on the drying frames. These are wooden frames about six feet six inches long, with marsupial netting and calico stretched upon them. They are placed away from any dust or smoke, and the wind passing underneath, as well as the sun above, aids in the drying process. But the sun and air are not alone trusted with the drying. A drying house has been erected, capable of accommodating 180 frames. This is heated by steam pipes to 140° Fah. The value and market price of arrowroot depend so much on the color and quality, that the greatest care is necessary throughout its manufacture, and only very clear water is used in the washing.

* From the *Pharmaceutical Journal of Australasia.*

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THE PECOS RIVER BRIDGE.

One of the two or three highest bridges in the world is the viaduct over the Pecos River, Texas, which was completed last year, and is shown in our first page illustration. It is on the line of the Southern Pacific Railway, and its construction shortens the former line of the road by 11·2 miles, besides saving some heavy grades and avoiding bad curves. The bridge is 130 feet longer than the famous Kinzua viaduct, built in 1882, and 18 feet higher, while its longest span is 185 feet, against a span of only 61 feet as the longest in the Kinzua structure. A somewhat higher and similar bridge is the Loa viaduct, erected in Bolivia in 1889, but the longest span of the Loa structure is only 80 feet, and its total length but 800 feet, the height being 336 feet.

The Pecos River bridge is 2,180 feet long between abutment walls, and it is built of plate and lattice girders resting on steel towers. There are 34 tower plate girder spans, each 35 feet long; one plate girder span 54 feet long; eight latticed spans 65 feet long; two cantilevers 102 feet 6 inches long each; two cantilevers 70 feet long each, and one suspended span 80 feet long. The height from the base of the rails to the surface of the water is 320 feet 10¾ inches, and to the bed of the river is 330 feet. It has 23 supporting towers, all but the two supporting the cantilevers being built of steel Z-bars. All of the towers rest on cut stone piers, some of the piers in the bottom of the gorge being carried down 30 to 40 feet to bed-rock. The anchorages for the tower feet carrying the cantilevers and the shore arms for the cantilevers were built into the piers; but for the other towers the anchor bolts were set in Portland cement mortar after the completion of the piers. A wind pressure of 50 pounds per square foot is provided for with the structure unloaded, and 30 pounds when loaded.

The principal dimensions are as follows:

	Feet.	Inches.
Total length	2,180	
Height above surface of water	320	10¾
Length of longest bent	241	0¾
With of towers, center to center of bents	35	
Longest span	185	
Width over all	16	
Width, center to center of trusses	10	
Gauge of railway	4	8½
Weight of iron work	1,820 tons.	
Batter of posts	1 in 6	

In erecting the iron work a traveler was employed which had an arm 124 feet 6 inches long, with a wheel base of 57 feet, and composed of two main trusses 10 feet apart, which carried the weight of the overhanging part and rested directly over the girders of the viaduct, and two secondary trusses, 18 feet apart, built in the support. The structure was built of pine, except the iron tension members and pin plates, and a 4 foot space between the inside and outside trusses was filled with 50,000 pounds of rails, an addition to the counterbalance being made by clamping to the top chord of the supporting girders.

After completing the eastern half of the suspended span the traveler was taken apart and carried a distance of 37 miles by rail to reach the place where it was to be set up at the western end of the structure. On its working deck were two boilers supplying steam to two engines, each having four spools working independently, and on the lower chord of the arm ran a car supporting an A-crab, by which all iron was raised and carried out to a point over its intended position in the structure. Some of the pieces weighed more than ten tons each. In erecting the pairs of cantilevers the portions over the towers were first erected, the shore cantilevers being then built from the tower toward the shore, when the traveler was moved back over the towers to erect the suspended span. To make the adjustment for connecting the halves of the suspended span a 20 ton hydraulic jack was employed.

The work of erection was begun November 3, 1891, and, although there were some interruptions, the halves of the suspended span were connected February 20, 1892, an average force of 67 men being employed for 87 working days, and the rate of progress being 750 lineal feet per month. The work of erection was in charge of Mr. H. D. McKee, representing the Phœnix Bridge Company, by whom all the details of the structure and methods of building were designed, under the supervision of Mr. A. Bonzano, chief engineer of the company.

The Diamond in Meteoric Iron of Canon Diablo.

After the author's researches there can be no doubt as to the existence of diamond in meteoric iron. This is the first time that this precious stone has been found in what may be considered its primitive gangue. In all the rocks where it has been hitherto met with, even in the pegmatite of India, we may see that it has been introduced as such during the formation of the rock. Here, on the contrary, the very state of the diamond, which appears as a fine powder disseminated in certain parts of the meteoric iron, seems to indicate that it has taken its origin on the spot, and has been formed during the consolidation or the crystallization of the mass.—*C. Friedel, Comptes Rendus.*

Correspondence.

A Phenomenal Well.

To the Editor of the Scientific American:

The articles in the SCIENTIFIC AMERICAN of the 7th and 14th of January relative to breathing or barometric wells induces me to describe to your readers through your valuable journal a phenomenal well located here in Beardstown, Ill.

This well was drilled in 1891, the strata pierced being 100 feet of drift as sand and gravel, 200 feet of corniferous limestone, 200 feet of slate and shale, passing into 20 feet of crystallized sandstone, a depth altogether of 520 feet. At this depth water began to rise in the well, and when reaching the surface spouted up to a height of 50 feet. The water is a saline mineral water, strongly impregnated with natural gas. The pressure gauge indicated 60 lb. Sufficient gas was obtained to supply two 60 horse power boilers with fuel. This well flows or spouts for eight days, when it ceases for twenty days, not varying a day from these periodic intermissions since it first began flowing. It invariably begins with the new moon. The quantity of water discharged is 4,000 gallons per hour. The gas is still utilized, "when well flows," in an electric lighting station near by. There has been no perceptible diminution in the quantity of gas or water. The well ceased spouting January 28; it is due and will certainly begin again February 15, after twenty days' rest. Occasionally for a display or exhibition the well is ignited ("without separation of the gas") and a fountain of fire is produced—the fire and water mingling to a height of 50 feet, producing a marvelous sight.

What is remarkable about this well is its periodicity. Can you, Mr. Editor, or any of your readers, enlighten me as to the cause? DR. H. EHRHARDT.

Beardstown, Ill.

Recent Decisions Relating to Patents.

PATENTABILITY.

Letters patent No. 290,571, issued December 18, 1883, to S. B. Goddard, for an improvement in the method of reducing corn in the stalk and separating the kernels, consisting of a cutter with feed rollers in front, a beater or thrasher, a revolving screen or separator, and a shaking screen under it, all mounted in one frame, and so geared that the parts are driven by a single band wheel, are void, since it consists of old and well known devices, not so combined as to form a single machine. 1.

The forty-third claim of patent No. 380,346, issued April 3, 1888, to Willis J. Perkins, for an improvement on a shingle sawing machine, consisting of the combination with a saw carriage of a wooden block furnishing a bearing for the same, and an oil-retaining trough in which the block is seated, is not void for want of patentable invention, the blocks formerly in use being of iron. 2.

The fourth and fifth claims of letters patent No. 401,871, issued April 23, 1889, to Edwin O. Abbott, for a device for cutting figures or letters in bank checks, which claims are for the combination of a stationary feed roll, a rotatable shaft, fixed at one end and movable at the other, and a lever to move the shaft, are void for want of invention, since the only difference between that and prior machines is that the lower roller, instead of the upper one, is made movable. 3.

NOVELTY.

Letters patent No. 231,147, issued August 17, 1880, to C. P. Buckingham, for an improvement in plow beams, consisting of "the combination of an upper and a lower flange, an upper and a lower fillet, and a concavity between the fillets on each side of the plow beam," are void for want of novelty. 4.

Letters patent No. 211,052, for a dumping wagon, are to be construed as for a dumping wagon wherein the body is raised front and rear simultaneously, by folding arms connected with the body and running gear, and suitable connections between the forward ends of the arms and wagon body, whereby, as the latter is raised, it moves rearwardly also with a single power device operating upon one or more of its arms, whereby a single continuous operation will elevate both ends of the body, and move it rearward, and embrace patentable novelty. 5.

The first and third claims of letters patent No. 380,346, issued April 3, 1888, to Willis J. Perkins for improvements in shingle sawing machines, which claims are for the combination of a shingle sawing machine with a lever fulcrumed near the central shaft, so that shaft and carriage may be lifted so as to permit access to the saws, and having a catch piece to lock the lever in position, are void for want of novelty. 6.

INFRINGEMENT—WHAT CONSTITUTES.

Claim 2, which covers a combination of "a reflector constructed with an opening behind the burner, and an auxiliary reflector, whereby the light emitted backwardly through such opening is directed toward the signal plates or lenses," must be limited to a combination of the reflector of the first claim, with its improved opening and an auxiliary reflector, and is not infringed by a reflector with any opening behind the burner and an auxiliary reflector. 7.

A bill which sets forth a patent for a "process" of making furniture nails, and then alleges that defendant, "in infringement of the aforesaid letters patent," did wrongfully "make, use and vend to others, to be used, furniture nails embracing the improvement set forth and claimed" in said patent, is demurrable for want of a sufficient allegation of infringement of the process. 8.

In a suit for infringement of a patent the usual decree for a perpetual injunction and accounting was passed after a full hearing on the merits. More than two months thereafter defendant petitioned for a rehearing and dissolution of the injunction, which was afterward denied. Pending this petition the circuit court of appeals was created. *Held* that, assuming the decree for injunction and accounting to be an interlocutory decree, from which an appeal would lie to that court within thirty days under section 7 of the act creating it (act March 3, 1891; Supp. Rev. St. 901), yet the order denying the rehearing was not appealable, for it was not an interlocutory decree or order continuing an injunction, within the meaning of that section, and it is immaterial that there was no right of appeal at the time the injunction was granted. 9.

OFFENSES AGAINST PATENT LAWS.

The patentee of wooden dishes which might have been marked "Patented," etc., as required by section 4,900, Rev. St., did not stamp the dishes, but only the crates in which they were packed. Upon a suit for penalties under the second paragraph of section 4,901 against the defendant for placing a similar stamp upon crates of similar dishes made by the defendant without license, *held*, on demurrer to complaint, that sections 4,900 and 4,901 must be construed together; that the stamping of articles capable of stamping was necessary; and that the stamping of the crate containing them was insufficient, and was not protected by sections 4,900 and 4,901; and that a similar stamping of his own crates by the defendant did not render him liable to any penalty. 10.

1. Appleton Mfg Co. *v.* Starr Mfg. Co., 51 Federal Reporter, 284.
2. Perkins *v.* Interior Lumber Co., 51 Federal Reporter, 286.
3. Abbott Machine Co. *v.* Bonn, 51 Federal Reporter, 223.
4. Buckingham *v.* Springfield Iron Co., 51 Federal Reporter, 236.
5. Rodenhausen *v.* Keystone Wagon Co., 51 Federal Reporter, 220.
6. Perkins *v.* Interior Lumber Co., 51 Federal Reporter, 286.
7. Steam Gauge and Lantern Co. *v.* Williams, 50 Federal Reporter, 931.
8. Am. Solid Leather Button Co. *v.* Empire State Nail Co., 50 Federal Reporter, 929.
9. Boston & A. Ry. Co. *v.* Pullman's Palace Car Co., 51 Federal Reporter, 305.
10. Smith *v.* Walton, 51 Federal Reporter, 17.

The Atlantic Sea Bed.

Proceeding westward from the Irish coast the ocean bed deepens very gradually; in fact for the first 230 miles the gradient is but 6 feet to the mile. In the next 20 miles, however, the fall is over 9,000 feet, and so precipitous is the sudden descent that in many places depths of 1,200 to 1,600 fathoms are encountered in very close proximity to the 100 fathom line. With the depth of 1,800 to 2,000 fathoms the sea bed in this part of the Atlantic becomes a slightly undulating plain, whose gradients are so light that they show but little alteration of depth for 1,200 miles. The extraordinary flatness of these submarine prairies renders the familiar simile of the basin rather inappropriate. The hollow of the Atlantic is not strictly a basin, whose depth increases regularly toward the center; it is rather a saucer or dish-like one, so even is the contour of its bed.

The greatest depth in the Atlantic has been found some 100 miles to the northward of the island of St. Thomas, where soundings of 3,875 fathoms were obtained. The seas round Great Britain can hardly be regarded as forming part of the Atlantic hollow. They are rather a part of the platform banks of the European continent which the ocean has overflowed. An elevation of the sea bed 100 fathoms would suffice to lay bare the greatest part of the North Sea and join England to Denmark, Holland, Belgium, and France. A deep channel of water would run down the west coast of Norway, and with this the majority of the fiords would be connected. A great part of the Bay of Biscay would disappear; but Spain and Portugal are but little removed from the Atlantic depression. The 100 fathom line approaches very near the west coast, and soundings of 1,000 fathoms can be made within 20 miles of Cape St. Vincent, and much greater depths have been sounded at distances but little greater than this from the western shores of the Iberian Peninsula.—*Nautical Magazine.*

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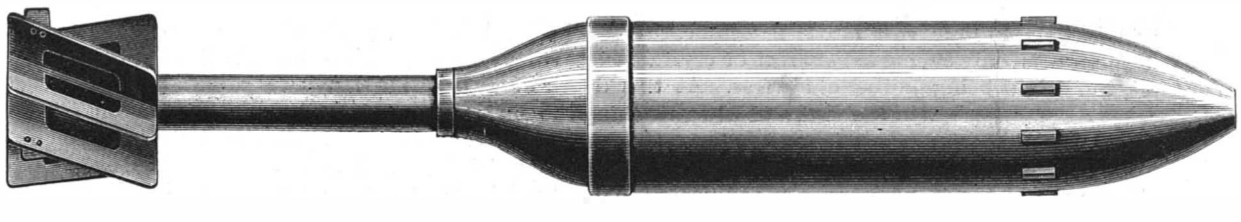
TRIAL OF THE PNEUMATIC CRUISER VESUVIUS.

The pneumatic dynamite cruiser Vesuvius has been awarded a second and more exhaustive trial to determine her efficiency in projecting aerial torpedoes by compressed air. The torpedoes are discharged from the so-called Zalinski gun. These weapons represent the ideas of some years ago. In practice from a stationary land platform they have shown the highest degree of efficiency. The destruction of the schooner Silliman, described and illustrated in our issue of October 1, 1887, showed the terrible powers of the weapon as a torpedo thrower.

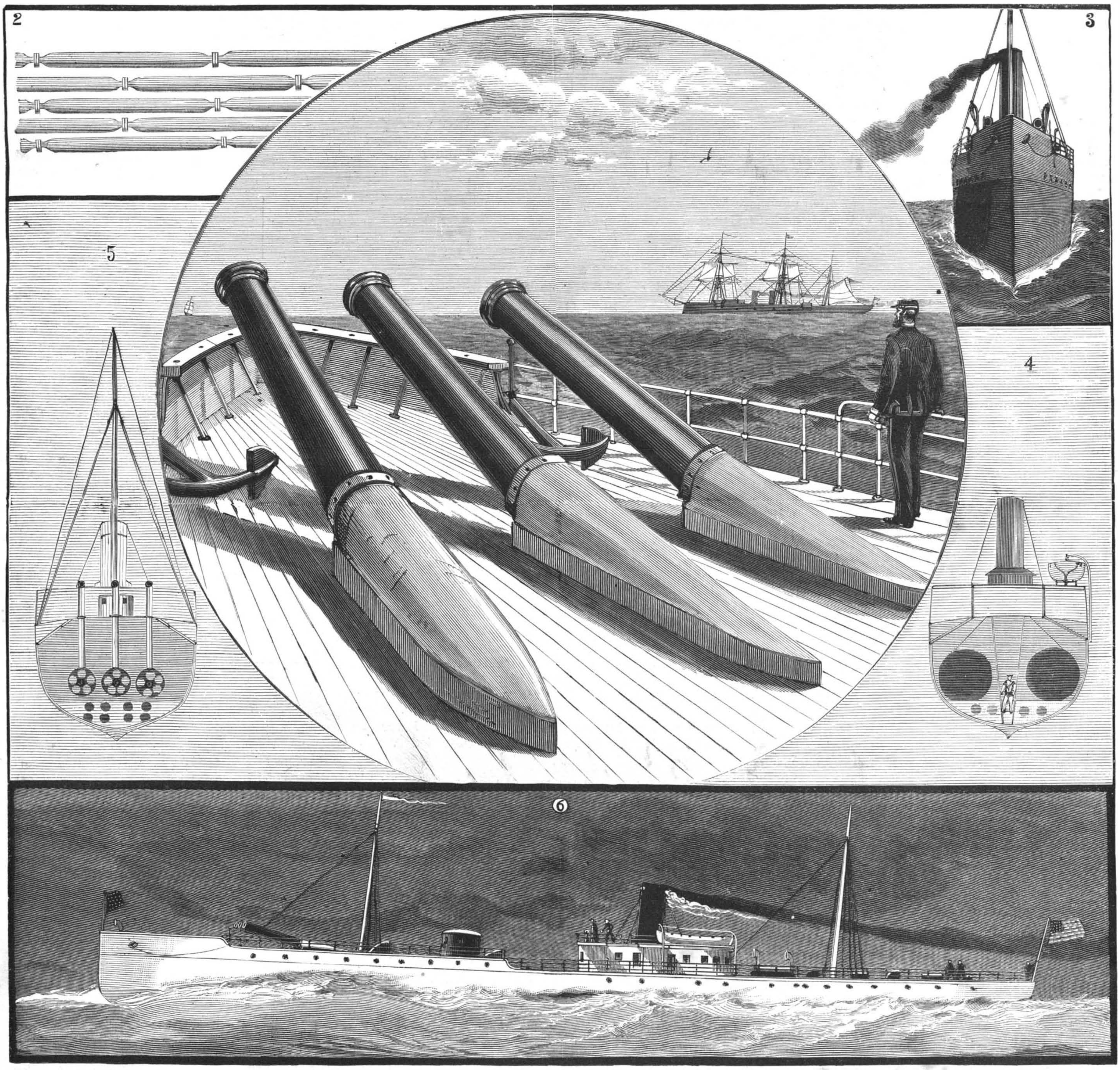
The Vesuvius was built at Cramps' ship yards and was launched April 28, 1888. The object in building her was to secure high speed and powers of maneuvering. In action she is to run up quickly within a mile of the enemy, discharge her torpedoes, annihilating the target in as few shots as possible, and then to retreat. Her fighting is done under peculiar circumstances. She must be bow on to her target. Thus she offers a small mark. She can do no broadside fighting whatever.

The first trial of the ship as a torpedo thrower took place nearly a year ago, and did not impress our naval authorities favorably. The present trials are designed to determine definitely the value of the guns and torpedoes, and the accuracy which will be attained with them in stationary practice and when the cruiser itself is moving. If the vessel proves a failure in her proper capacity she will be transformed into a dispatch boat, torpedo boat, or other type. The general plan of the cruiser provides a very fast ship with three guns arranged at an elevation. The guns are for most of their length inclosed within the hull; but their muzzles project, side by side, from the forward deck, as shown in one of our engravings. The ship is of 725 tons displacement, 252 feet long and 26½ feet wide. She draws 9 feet of water and is practically unarmored. Some protection is given by her coal bunkers and deflective deck. Her engines, of 4,000 horse power, are designed to drive her at the speed of at least 20 knots. There is no question that in view of recent achievements this speed is too low. One shell entering her hull would probably annihilate her by exploding the tons of guncotton in her torpedoes. The guns are set at an angle of elevation of 18°; they are 15 inches in diameter, 54 feet long, and are made of thin cast iron. Under each gun, and toward its breech, is placed what is known as the revolver. This is a cylindrical structure, resembling an enlarged revolving cartridge chamber of a pistol, and arranged to carry five projectiles. To load the gun, the rearmost section of the gun, which is pivoted at the back, is dropped to a horizontal position, in line with one of the chambers of the revolver. See Fig. 2. The shell is introduced and the forward end of the gun section is again drawn up in line with the rest of the barrel by means of a vertical pneumatic ram. Our cuts show the general disposition of all of these parts. It will be seen that when the revolving cartridge chamber is charged with five shells, after one has been loaded and discharged, a simple turn of the chamber brings another shell into loading position, so that the five can be rapidly introduced and fired.

The ship is steered by steam and has twin propellers. Thus she has high maneuvering ability, and it will be seen that this is very essential. It is to be regretted that water jets at bow and stern have not been applied to increase her turning powers. The range of the projectiles, as the guns have a fixed elevation in still water, is determined entirely by the amount of air admitted



THE RAPIEFF PROJECTILE FOR PNEUMATIC GUNS.



1. The central cut shows the bow of vessel and the mouths of the pneumatic guns. 2. The storage air cylinders. 3. Bow view of the vessel. 4. Cross section, showing position of boilers. 5. Section showing the pneumatic guns. 6. The Vesuvius running at full speed.

THE UNITED STATES TORPEDO CRUISER VESUVIUS.

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for the discharge. The range being thus regulated, the direction has to be determined by changing the position of the ship. The ship, in other words, represents a gun carriage, and the pointing of the gun is effected by making the ship point in the desired direction. The necessity for high capacity of maneuvering is obvious.

Accuracy in firing will be interfered with by several things. The pitching of the ship will alter the trajectory by giving different elevations of the guns. The rolling of the ship will also affect the elevation of the discharge, and at the same time will give a right hand or left hand deflection according to the direction of the roll.

The compressed air supply for the guns and pneumatic machinery is supplied by two Norwalk compressors. These force the air into tubular reservoirs, each 16 inches in diameter and 13-16 of an inch thick, made of wrought iron; some of the tubes are 20 feet and others are 25 feet in length. It was proposed to store the air at 2,000 lb. pressure per square inch, and to maintain the firing reservoir at a pressure of 1,000 lb. per square inch.

The three guns were built four or five years ago and do not, of course, represent the most modern type. In these trials the most recent projectiles of the Rapieff construction are employed, and are considered an important advance on the old shell. For much of the work dummy shells made of iron are used to save expense.

We illustrate the Rapieff shell as it is designed to be definitely used in warfare. For the 15-inch gun, which is the size in use on the Vesuvius, the entire shell is 10 feet long, including tail and wings. The extreme length of the head is 91 inches. The front of the head is of cast bronze, the middle cylinder is of wrought iron and the base is of cast bronze. The tail is a 6-inch bronze tube, 34½ inches long, of which 29 inches project from the rear of the head. The head is filled with 500 pounds of wet guncotton. This is a peculiarly safe form of explosive, far safer than dynamite or explosive gelatine, the explosive originally proposed, as it is almost impossible to explode it except under definite conditions.

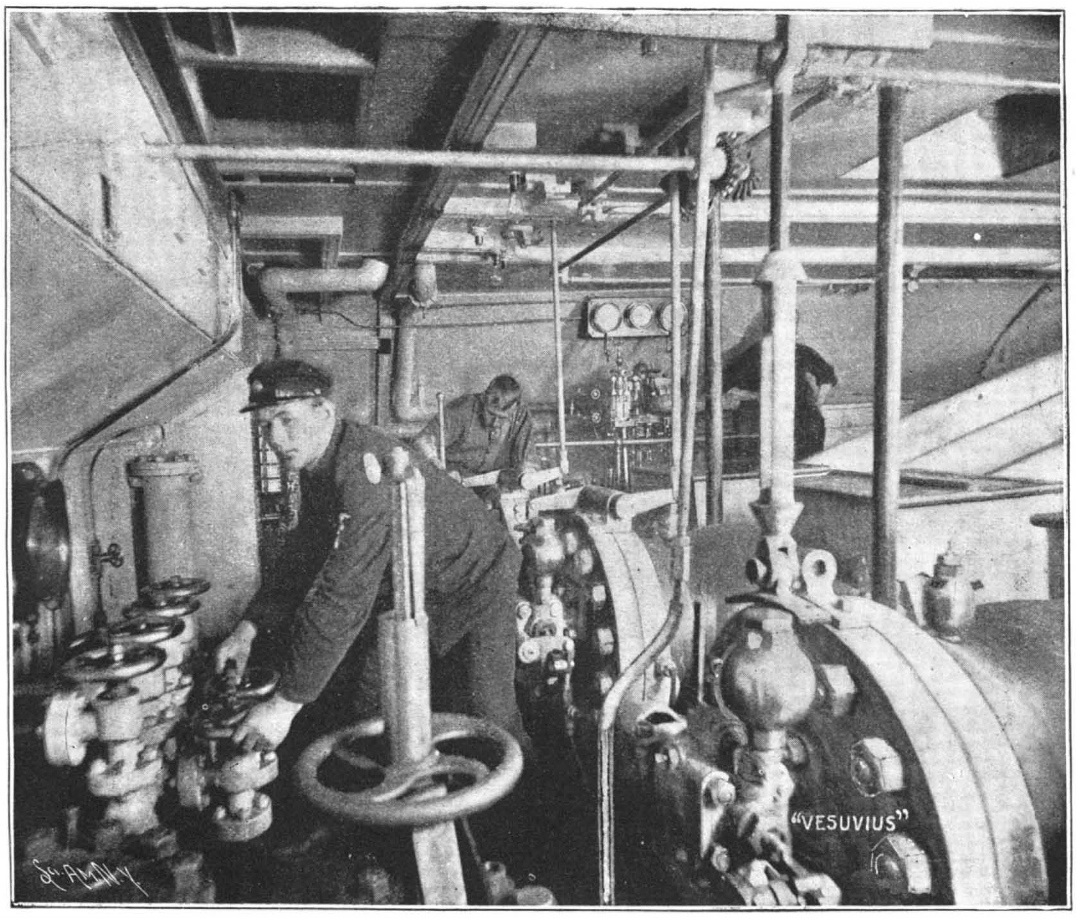

Fig. 1.—THE FIRING BREECHES—TORPEDO BOAT VESUVIUS.

These conditions are supplied in practice by what is known as a priming charge of dry guncotton. This is inserted into a cylindrical chamber in the axis of the explosive. In the ordinary type of shell, the primer comes immediately in front of this dry guncotton. The primer works mechanically by three methods. Within a little chamber a ball is held at the rear of the chamber by a spring. If the projectile strikes the water or soft earth, its speed will be retarded and the inertia of the ball carries it forward, where it strikes a firing pin and explodes some fulminate. When earth or water is struck, it is desirable to have the torpedo penetrate before exploding; hence the flash from the fulminate does not at once reach the guncotton, but sets on fire some slow-burning composition. When this is all burnt up, it effects the explosion of the dry guncotton, which, acting as a priming charge, causes the whole mass to detonate.

The condition of impact against the sides of an ironclad is next provided for. This effects a similar type of inertia discharge except that the direct impact against the head of the shell brings about an instant ignition of the dry guncotton so as to produce the detonation without delay. Finally side impact against the forward portions of the shell is provided for by surrounding it by eight firing pins, any one of which when forced inward produces instant ignition of the charge. Until the piece is fired these pins cannot effect the discharge, a metal slide or gate intervening between their ends and the fulminate. This slide, on the discharge of the piece, is sprung out of its position, so as to leave the crown of firing pins free to act.

On board the ship it is proposed to keep the shells charged with wet guncotton. The primers and priming charge are only introduced shortly before firing.

The shell has 12 helical wings at the extremity of its tail piece to give it direction and spin. In the full caliber projectiles, every second wing carries a little block of fiber to center the rear and to prevent the wings from touching the walls of the gun. A 1½ inch oak shield or disk is attached to the rear to protect the wings. This drops off as the projectile leaves the gun. At the base of the head is the gas check, and a number of small blocks of fiber encircle the head to hold it in axial position. Shells of less than the proper diameter known as sub-caliber shells are also used. These are centered at the rear by a disk-shaped gas check.

The front is centered by four oak sabots or shoes. As the piece emerges from the gun these are displaced by the blast of air, so that in all cases the projectile accomplishes its flight without any impediments. The trial so far has been exceedingly satisfactory, and it is believed that certainly an important advance in the art of war has at last been evolved.

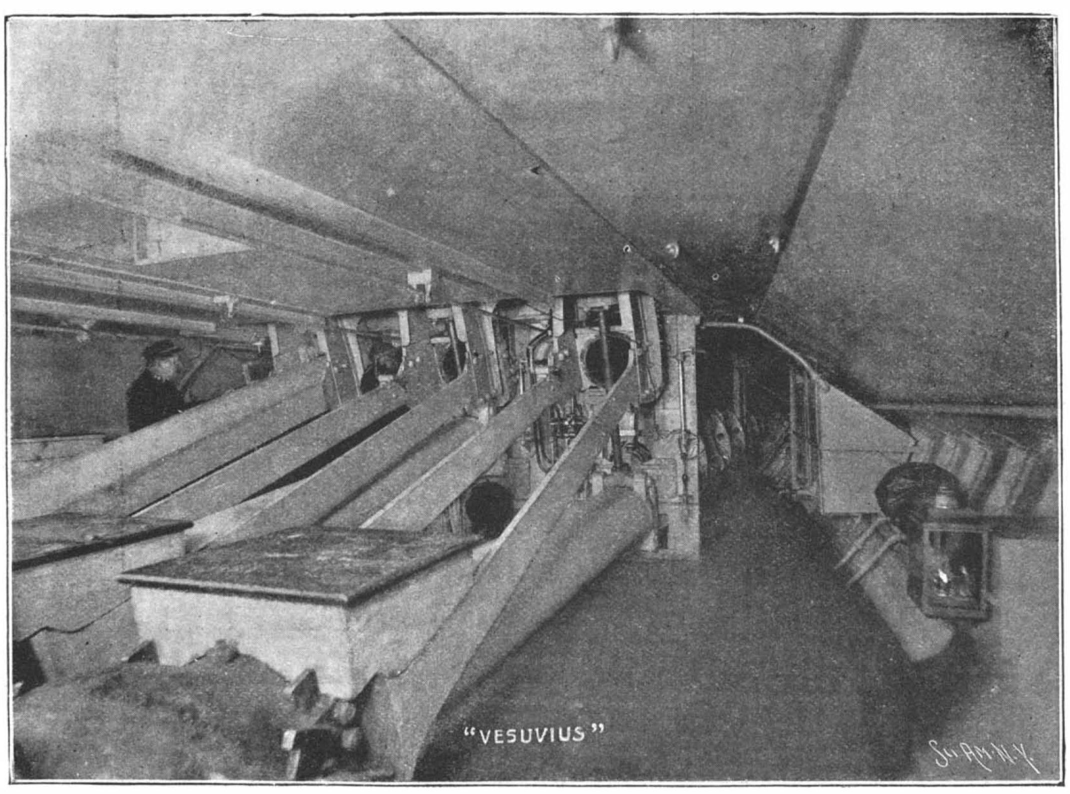

Fig. 2.—THE LOADING TUBES—TORPEDO BOAT VESUVIUS.

The first of the present series of trials were made with the vessel fast to the dock. Exhaustive trials of accuracy when in motion will follow. The critical test, however, is the hitting of a moving target. At Port Royal, S. C., the place of the trial, the best possible facilities for all this work are present.

Nine Hours' Work for Ten Hours' Pay.

"Have you ever realized," said a business man recently, "what nine hours' work for ten hours' pay means? Supposing a factory employ fifty hands at two dollars a day, which is twenty dollars an hour for ten hours' work. Therefore nine hours' work means giving each man twenty cents a day, the fifty men ten dollars a day, or three thousand dollars for the three hundred working days in a year. But that is not all. In order to turn out the same amount of output, the manufacturer must make up this one hour by hiring one new man for every nine men, or five new men for the fifty men. The five new men, at two dollars a day, cost ten dollars a day, or another three thousand dollars for the three hundred working days, a total of six thousand dollars, or twelve per cent extra cost on an output of fifty thousand dollars. If the manufacturer does not make up the lost time by hiring the new men his pay-roll has, nevertheless, increased three thousand dollars a year, while his output will have decreased ten per cent, because of the one hour in every ten granted the men. It means again additional space or additional machinery for the five new men, which represents another three per cent at least. Thus you see that the demand for ten hours' pay for nine hours' work, which looks so innocent on its face, amounts to fifteen per cent extra expense on the cost of the goods, when the average profit is only about six per cent. Therefore, except this is made a universal rule everywhere, any manufacturer granting it will simply be wiped out by the competition, having this fifteen per cent disadvantage."—*Cincinnati Commercial Gazette.*

Oil Fuel at the Fair.

Oil will be the fuel used in the large steam plants of the Columbian Exposition, and it will be furnished by the Standard Oil Company at the price of 72½ cents per barrel of 42 gallons delivered on the grounds, so says the *Railway Master Mechanic.* The Standard Oil Company guarantees to furnish all the oil that may be required at this figure, and will deliver it through an extension of one of its pipe lines which now enters South Chicago. The Exposition Company will provide sufficient storage capacity by constructing twelve tanks, each 8 feet in diameter and 25 feet long and holding 9,400 gallons, or a total of 112,800 gallons. The tanks will be placed underground in a suitable vault. From these tanks the oil will be pumped into a stand-pipe, 30 inches in diameter and 300 feet high, by two Snow duplex pumps. This pipe is connected with the 5 inch wrought iron main leading to the boilers.

Mercurial Ointment.

A recommendation by H. Borntraeger, according to which it is possible to make an ointment containing 98 per cent metallic mercury, consists in triturating the mercury with oleate of mercury; the ointment of this strength is suitable for preparing the officinal ointment by diluting with lard. It is also considered feasible to change the liquid character of mercury to that of a solid with the aid of a little oleate of mercury and thus avoid the shipment of a troublesome liquid. After transportation ether will extract the oleate, leaving the mercury again in the liquid state.—*Pharm. Post, 1892, 1245; American Journal of Pharmacy.*

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Equity in Patent Cases.

BY J. C. CLAYTON.

Whether or not the United States courts, sitting in equity in patent cases, will venture to show a larger liberality in prescribing conditions for the granting of injunctions is a grave question. The statutory patent law rests upon the constitutional provision authorizing the granting of privileges to authors and inventors for the purpose of promoting the progress of science and the useful arts; and the Constitution itself was made to promote the general welfare of the people.

When, therefore, the law is so enforced as to maintain a monopoly that is destructive of the promotion of science or art, or that is against the general welfare, there is a violation of the constitutional and fundamental prerequisites. Though the patentee receives an exclusive grant, he remains subject to those constitutional qualifications; he cannot override them, nor can he overthrow the maxim, *Sic utere, non abutere.* No court of equity should sustain a patentee in the non-use or the misuse of his invention. His patent is a contract between himself and the government representing the people, and is the result of a public policy primarily created for the welfare of the people.

Few inventors have ever long anticipated others in the same field; although, for his priority, the inventor gets a patent, yet, as a rule, in a few days or a few years others would have reached the same result. It is therefore against natural justice that a right so given by the people should be used for extortion or oppression, or in any way against the general welfare. In a mere race of diligence Jones may secure a patent for a lamp over Smith, who may have been too late by one day, and Smith may have other cognate valuable inventions useless without the privilege of the Jones patent. Both may be great and successful manufacturers of lamps, and through their healthful competition the people may be greatly benefited. But, if Jones be upheld in his determination that Smith shall not on any terms use the Jones patent, then an "odious monopoly" is created, fair competition is destroyed, Smith is ruined, and the people are completely at the mercy of Jones, the monopolist.

In such a case it would seem that a court of equity should be able to refuse its peremptory injunction if Smith should secure a reasonable license fee to Jones. In other words, in the high court of conscience (the "court of equity") the familiar and highest principles of equity should govern; and the wrong of a harsh injunction should be balanced against the wrong of an infringement, while the court, holding a just balance between the actual parties, should remember that the public is, in no narrow sense, always an interested party in every suit upon a patent. I know that, *strictissimi juris*, an exclusive right is granted to the patentee, and that in a suit, on the law side of the court, this legal right, no matter how harsh it may be, must be enforced. But if the patentee elect to enter the court of conscience rather than the court of law, he must abide by its more liberal and merciful conclusions. Generally, "equity follows the law," but not to enforce the unconscionable or the cruel, nor to uphold unclean or unmerciful hands. Generally, too, when a patent is finally sustained on the merits, an injunction follows, which practically leaves the respondent and his business to be executed by the complainant without mercy or benefit of clergy! My view is, that there must be a new departure in this respect, either by judicial construction or by statute. And although I took no part in the incandescent lamp case, I was not without a hope that the court might find occasion to take the new departure above suggested.

Indeed, to a notable extent, it did depart from the harsher practice of the past, for it granted leave to apply for a dissolution of the injunction in case the complainant refused to supply its lamps to respondent's customers upon reasonable terms. To this extent I think the court made an advance in the line of mercy and liberality which has been herein suggested; perhaps in the next great patent case, where the respondent has his own additional patents and has invested millions in his plant, the court will go the length I have indicated and permit the respondent to continue his manufacture upon reasonable terms fixed by the court, with due regard to the interests of the parties and of the people.

Unless courts of equity more nearly approach such liberality, as they may by force of construction and constitutional law, some arbitrary statute inimical to patents will soon be enacted. Even now several harsh patent bills are pending in Congress. One authorizes the Secretary of the Interior and the Commissioner of Patents to fix the maximum price for the use of a patent, and provides that in case of a higher price being demanded the patent shall be forfeited to the public; another limits the term of a patent to seven years. In the wise and very liberal administration of equity all interested in patents will find their truest protection.—*N. Y. Times.*

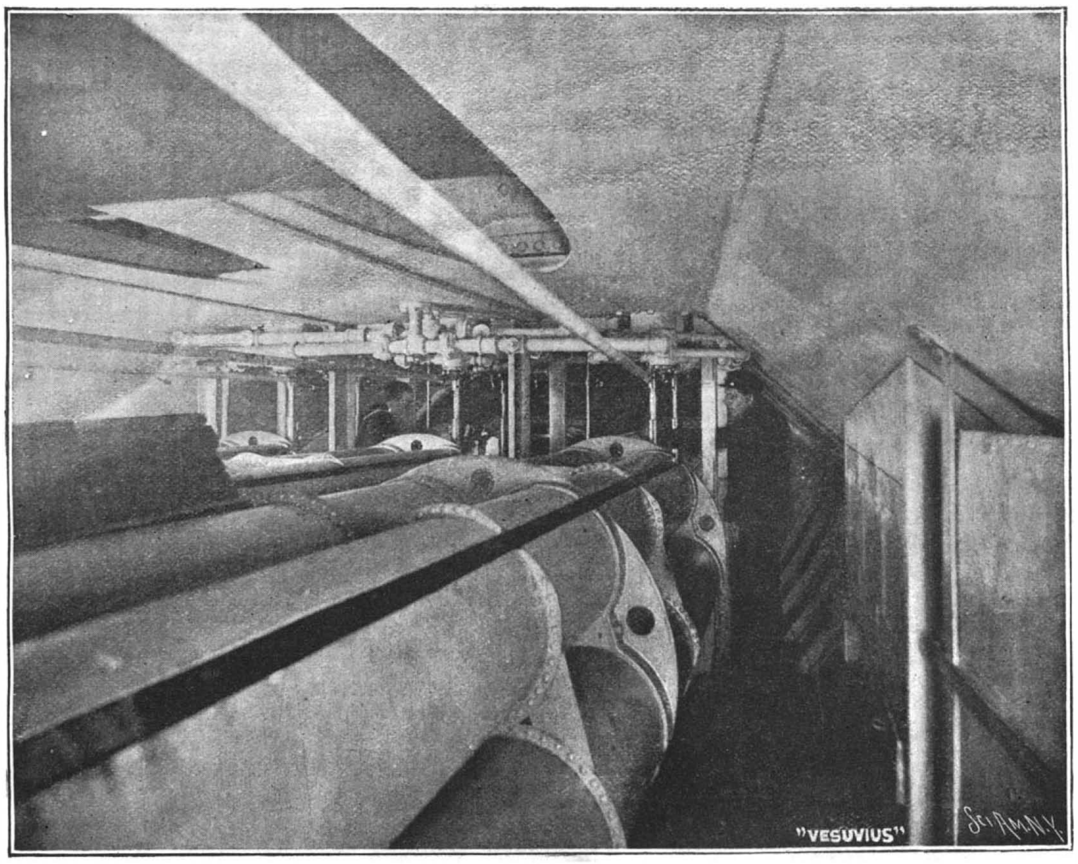

Fig. 3.—THE REVOLVING CARTRIDGE CHAMBERS—TORPEDO BOAT VESUVIUS.

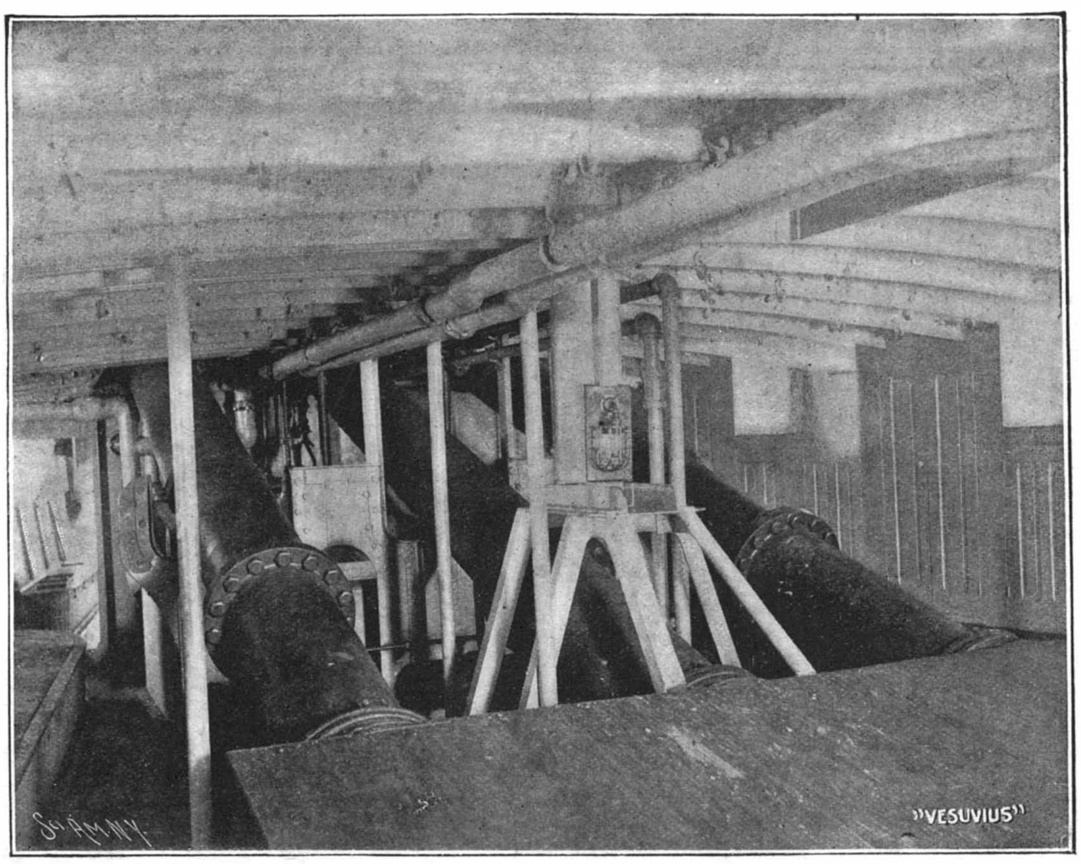

Fig. 4.—THE PNEUMATIC GUNS AS THEY APPEAR BETWEEN DECKS.

Spontaneous Combustion of Coal.

With respect to the ventilation of a cargo of coal, with the idea of removing inflammable gases, Professor Clowes, of Nottingham, has pointed out that this might itself be a source of danger. Four colliers were loaded with coal from the same seam, and by means of the same tips. Three were ventilated, and proceeded on their journey to Aden. None of these reached the port, being all lost by the spontaneous firing of their cargoes. The fourth was not ventilated, and it reached Bombay in safety. There was little doubt that the air inclosed in the cargo was insufficient to give rise to dangerous heating, and that the introduction of additional air by ventilation enabled the heating to occur by supplying the requisite air. Coal which had heated in the air and begun to cool again was safe from risk of further heating; hence, storing coal in the air for a sufficient length of time before loading was a precaution which would be calculated to insure the safety of the cargo.

The following practical conclusions were submitted as deducible from the facts presented: 1. The danger of spontaneous firing of coal in large lumps is very slight; it is much greater with small coal, and greater still with dust. The increase of danger is due to the larger extent of surface exposed to the air in proportion to the mass of the coal. 2. Air-dried coal which contains more than 3 per cent of moisture is dangerous; if it contain less, the danger diminishes, as the amount of moisture is less. The moisture present in the coal is a measure of its absorptive power for air, and the most absorptive coal is the most dangerous. 3. The danger is somewhat increased by the presence of pyrites, in large quantity, not because this heats the coal to any appreciable extent, but because, when moistened, it swells—breaking up the coal, and exposing a larger surface to the air. 4. Newly won coal should be shielded from the air as much as possible, to prevent the chance of rapid heating, and for the same reason it is best not to stack it in large heaps, since these retain the heat. Ventilation of the coal often adds greatly to the risk of spontaneous firing. 5. All external sources of heat, such as steam pipes, boilers, and hot flues in the neighborhood of the coal, add very greatly to the risk of firing. Spontaneous heating becomes vastly more rapid when it is thus assisted by outside sources of heat.

Pneumatic Tube Service.

The Postmaster-General on behalf of the United States has executed an agreement with the Pneumatic Transit Company, of New Jersey, by which the latter contracts to lay, at its own expense, a line of two parallel iron pneumatic tubes of an inside diameter of 6⅛ inches, for the transit of mails between the main post office building and the sub-post office on Chestnut Street, below Fourth Street, in Philadelphia. The company agrees to bear the entire cost of maintaining and operating them for one year, and to remove them when required to do so by the Postmaster-General. It will turn the tubes over to the Post Office Department for one year after completion for such practical tests as the postmaster at Philadelphia or the Postmaster-General may direct, without cost to the United States. The company will lease or sell to the United States.

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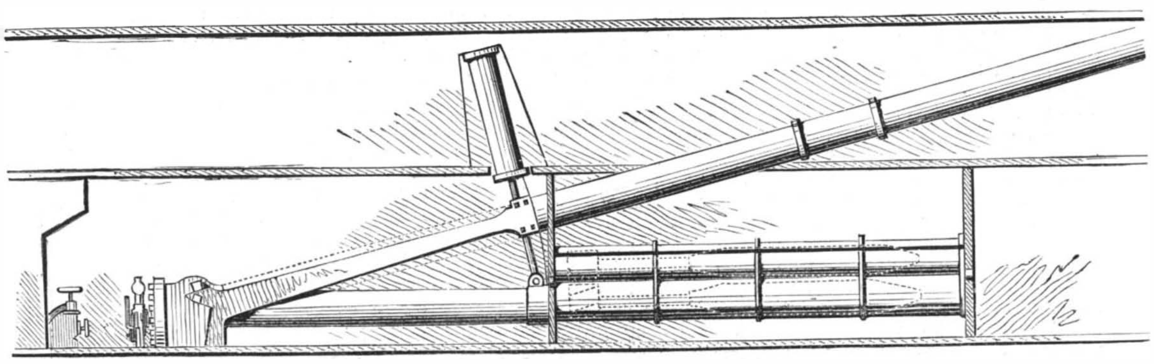
Model of the Caravel of Columbus.

The *Marine Review* says: The State Department has been informed that there has just been received at New York a large model of the caravel of Columbus, the Santa Maria, which was constructed on the island of Santo Domingo, under the personal direction and supervision of Senor Don Andres Gomozy Pintado, the secretary of the Spanish commission for the Madrid exposition. It was designed with great care from original drawings made by that gentleman, who is an enthusiast in such matters, and has paid much attention to ancient naval architecture, and is considered an expert, having made many studies from all the ancient engravings obtainable with this special purpose in view. This model is something more than a toy, being 18 feet in length, 6½ feet beam, having a depth at the stern of 8 feet, and is fully rigged. It was first used in the festivities with which the discovery of America was celebrated in the city of San Domingo, in October last, being carried through the streets of that town in the grand procession that took place, manned by a bevy of little girls as a crew. It was then placed in the river Ozama and sailed to the point of embarkation by the Clyde line for the United States. This reduced replica of the Columbus caravel was constructed at the suggestion of Mr. Frederic A. Ober, the Exposition commissioner to the West Indies, and will form part of the Columbian exhibit of the State Department at Jackson Park.



THE VESUVIUS—DIAGRAM SHOWING GENERAL ARRANGEMENT OF THE GUN-LOADING MECHANISM.

A FEAT IN HOUSE MOVING.

The ferry house located at the Brooklyn terminus of the 39th Street ferry between the Battery in New York and South Brooklyn, is a brick structure 52×110 feet. This building was located at the foot of 39th Street. The Brooklyn City Railroad Company required increased facilities in that part of the city, and in consequence of this the ferry house was removed from its original site 140 feet westward and 25 northward, and when the job is completed the building will stand 17 inches lower than it stood on the old site. This work was done in about one month, without injury to the walls, and at much less expense than would have been involved in tearing down and rebuilding.

The building was placed on a rigid framework and its walls were shored and braced by tie rods and cross timbers, as shown in Fig. 2, and it was moved on ways consisting of a framework of heavy timbers provided with diagonal guides which caused the building to move sidewise as well as endwise, the frame upon which the building rested being provided with shoes sliding upon the diagonal guides, as shown in Fig. 4. The abutments against which the moving screws rested were heavy timbers secured to the ways by means of chains, as illustrated in Fig. 3. After the screws which abut upon the timbers had been run out their full length, they were returned to their original positions and the timbers moved forward and again made fast in the manner indicated, when the operation was repeated.

This job was done by B. C. Miller & Son, of Brooklyn, N. Y., who moved the Brighton Beach Hotel bodily in 1888, after the damaging encroachment of the sea on the beach. The building was 465 feet long and 150 feet deep, three stories high and weighed 5,000 tons. It was moved 239 feet back of its original position upon 112 platform cars by means of six locomotives.

A Remarkable Bicycling Tour.

W. L. Sachtleben, of Alton, Ill., and Thomas W. Allen, of Ferguson, Mo., have arrived in San Francisco from Vancouver, B. C., after making a tour of the world on bicycles. On June 30, 1890, they finished their course of study at Washington University, St. Louis, and then started. They visited Washington, D. C., and on June 23 sailed from New York, landing in Liverpool on July 4. Their bicycles purchased and a tour made of the British Isle, thence to France, their route took them through Rouen, Paris, Chartres, Poitiers, Bordeaux and Marseilles. The Riviera route along the shores of the Mediterranean was followed, and Genoa, Rome and Milan, in Italy, were visited. At Athens the first long halt was made. To Constantinople was the next jaunt, and their preparations for the invasion of Asia were begun.

"Our first exploit, of which we are a little proud," says Sachtleben, "was the scaling of Mt. Ararat. We are the first Americans that reached the top, and the natives could hardly believe we had succeeded. We started on July 2 and reached the summit July 4. There we celebrated the American holiday by waving the American flag and firing off shots from our revolvers.

"On our return the Governor of Bayazid gave a dinner in our honor.

"Through Turkey in Asia we rode, and through Persia, visiting Teheran on our way.

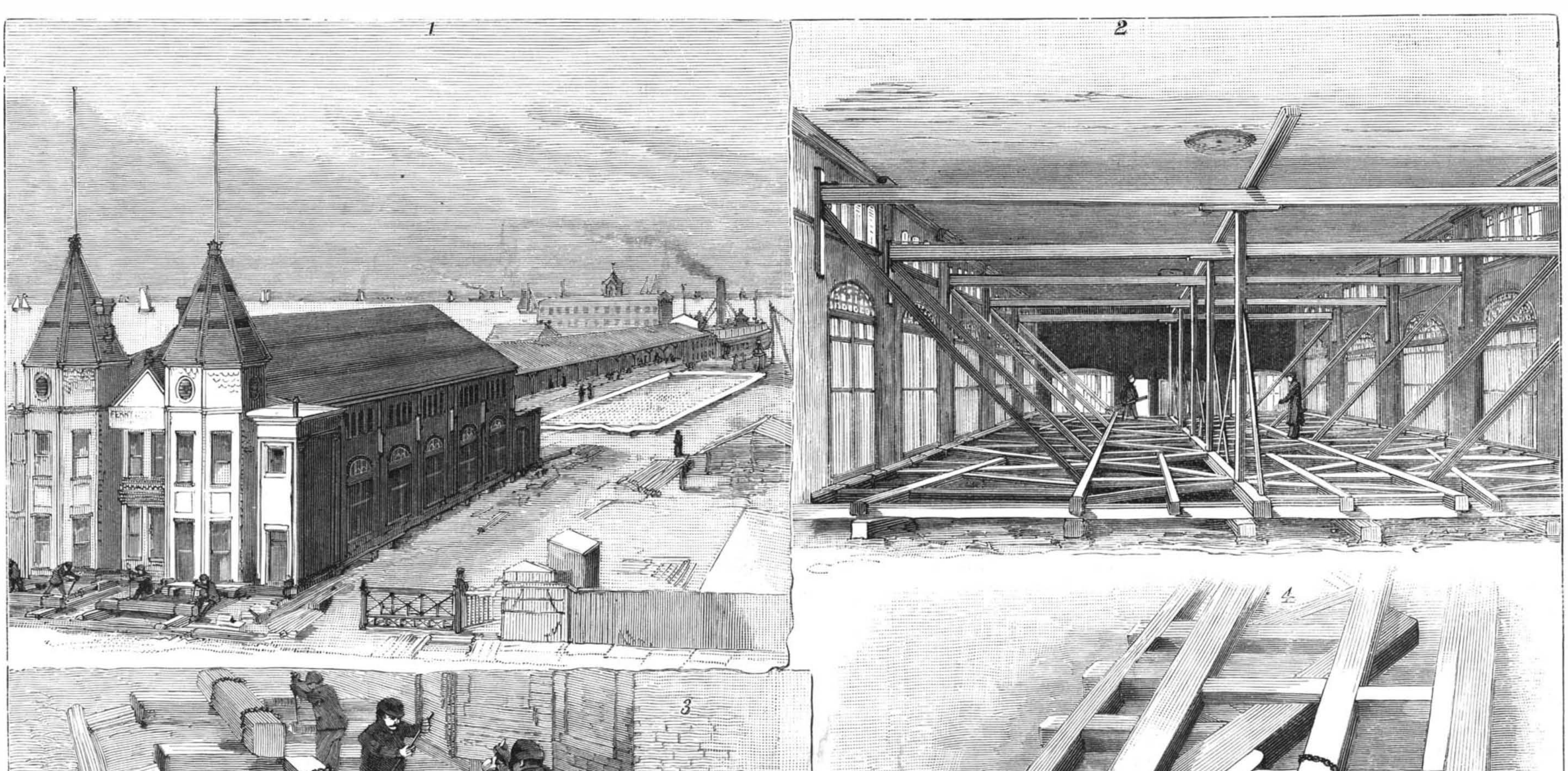
"Our journeying was along camel paths, there being no other roads. At Tashkend, the capital of Turkestan, we remained from November, 1891, to May 7, 1892, and spent a good deal of the time in studying the Russian language. We often had occasion to notice the eager attitude of Russian sentiment regarding the advance upon British Afghanistan. The Russians are very friendly to the Americans, and on this account we received many courtesies. Our last stopping place in Russian territory was at Vernoe, and here the people tried to dissuade us from making the attempt to go to China. Relying on a special passport which had been given us by a Chinese minister in London, we determined on trying to get through.

"After leaving Kulja the route was taken by way of the Urmpse to the border of the Gobi desert, at Hami, and there we were agreeably surprised at the character of the roads. In some places the desert had a hard bed, and this enabled the machines to make moderately good progress during the twelve days it took to cross."

Pushing on to Suchew, the western end of the Great Wall was reached, leading on to Lan-Choo. Then they proceeded to Singan, Ping-Yang, Tai-Yuan, and Poting-Fu, arriving at the latter place on the 20th of October, whence they rode to Pekin. The fact that they had already traversed China without personal inconvenience astonished all the diplomatic representatives there.

After resting there they went to Shanghai, where the machines were repaired. Afterward they intended to go to Japan, but received letters asking them to return home, so they left at once, touching at Nagasaki, Kobe and Yokohama, whence they sailed December 9 last. Sachtleben stated that while the trip in many respects had been a hard one, they enjoyed it greatly. They met with no annoyances from the natives in any of the countries passed through, excepting China.

To make ice by artificial means requires one ton of coal to produce from five to ten tons of ice.



MOVING THE BRICK FERRY HOUSE OF THE 39TH STREET BROOKLYN FERRY.

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RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR BRAKE.—Ferdinand Gabler, Topeka, Kansas. The brake shoes of this device are carried by toggle levers having sliding rods transversely pivoted at their outer ends, while arms pivotally connected with a longitudinally sliding block are pivotally connected at their ends to levers connected by links to the sliding rods. The construction of the shoe is of novel form, and the brake mechanism is attached to the under portion of the wheel truck, from which also the shoes are suspended.

LEVER ATTACHMENT FOR BRAKE WHEELS.—Benjamin Crawford, Louisville, Ky. This lever is formed of two sections, the inner one pivotally connected with the wheel to turn it, and having ears, while the outer section has an eye to receive a pivot pin passed through the ears. By this means the brake may be more quickly and conveniently manipulated, and the brakes when applied may be set with much more force than is possible with the ordinary wheel. When the lever is not in use, the outer or handle section may be turned over the inner section.

FOOT GUARD FOR RAILS.—William B. Mitchell and Frank Benberger, Galion, Ohio. This is a safety appliance for the heels and points of spring rail frogs, filling the converging spaces formed by them. It consists of a wedge-shaped, box-like piece, with securing devices to retain the piece between the converging rails by clamping it to the rail bases. The device is designed to remove the danger of persons wedging their feet in such parts of the frog, where pedestrians are sometimes caught and seriously injured.

SAFETY LOCK FOR SWITCHES.—Johan E. Sandelin, New York City. Combined with the main or side rails and switch points is a shifting rod with which are pivotally connected elbow levers having locking lips adapted to engage the flanges of the main or the siding rails, plates secured to the switch points being pivotally connected with the locking levers, in connection with means for reciprocating the shifting rod.

RAILWAY TIE.—Samuel McElfatrick, Princeton, Ky. This tie consists of a flat metal plate having on one side a depending flange adapted to be embedded in the ground, and on its opposite edge a vertical flange cut away at the proper places to receive the rail bases, the cut-away portion fitting over the outer edges of the rail bases. Attached to the vertical flange is a straining bar extending between the rails, and having a notched portion at each end fitting over the inner edge of the rail base. With this tie the rails are held in place without spikes.

CAR COUPLING.—Frank M. Stanley, Guthrie, Oklahoma Ter. This invention provides a coupling designed to be durable and inexpensive, and which will interlock automatically with a similar coupling on an approaching car, while the uncoupling may be effected from the top or side of the car. The improvement also comprises a self-acting hose coupling which will couple its sections at the same time with the car coupling, be held connected thereby, and be detached simultaneously with the release of the car couplings.

WIND GUIDES TO REMOVE SNOW.—Simon H. Dixson, Cleghorn, Iowa. According to this improvement posts along the car track have projecting arms to which are adjustably attached wings, adapted to be tilted by the pressure of the wind, in such way that the wind will be directed on the track to blow the snow therefrom. These wind guides or conductors are placed at such points on the road as would otherwise be liable to become blockaded by snow.

Electrical.

LAMP SOCKET AND TAP.—Alexander F. Vetter, New York City. This improvement has the usual device for attaching it to a wall socket, flexible cord, or other electric fixture, and made to receive an electric lamp in the usual way, but is furnished with an intermediate chamber containing a switch by means of which a current may be turned on or off the lamp, and is provided with electrical connections for receiving flexible cords or wires for taking the current from the socket either in parallel with the lamp or in series with it, according to the requirements for use in translating devices, such as electric motors, medical apparatus, etc.

The Manufacture, Clarifying and Charging of Liquids, etc.

To Mr. August Werner, of No. 52 Warren Street, New York City, six different patents have been granted for methods and means of filtering, separating, charging, steaming, filling and mixing, as employed in the manufacture of beer, wines, liquors, and other liquids.

The filter comprises a receiving vessel in which is suspended a series of connected frames, each provided with perforated transverse plates, a cover of filtering fabric inclosing each frame, while there is a layer of loose filtering material between the covers of adjacent frames and means for connecting the frames with each other to hold the filtering material clamped between them. Any desired number of frames may be united in the filter, which can be readily taken apart to clean the individual frames and the filtering material.

A froth and liquid separator consists of a receiving receptacle provided with filling nozzles, and connected with the base end of an inverted cone-shape liquid supply tube, the small end of which is connected with a supply cask, while a gas supply is connected with the cask to maintain a pressure on the liquid corresponding to the hydrostatic pressure in the tube, and the pressure desired in the vessels to be charged. If the bottles are to be filled with fifty pounds pressure, for instance, the pressure in the cask must be as great as this, and enough higher to raise the liquid to the bottles.

To charge liquids, such as wines, beers, etc., with a suitable gas under pressure, a pump connected with one end of a pipe causes the liquid to flow in a column to the receiving vessel, while a second pump connected with a gas supply is connected with the pipe at its lowest point to charge the liquid with gas under the hydrostatic pressure of the column of the flowing liquid.

To steam wine, beer, etc., preparatory to filling into kegs, casks, or bottles, the improved method provided consists of first forming a moving column of liquid and subjecting it to the action of heat at or near its base, under the hydrostatic pressure of the column, the heated liquid being then discharged into a receiving vessel at the initial pressure. The liquid is kept constantly in motion and all inlet of air prevented, so that the valuable properties of the liquid and gases are retained, the gas from the gas supply tank maintaining an equalizing pressure, and all further fermentation being prevented, whereby the liquid may be kept for a long time without being liable to spoil.

For the manufacture and filling of liquids such as beer, a reservoir is provided to collect the gaseous products of fermentation arising from the liquid in the fermenting tun, and these gases are purified to produce carbonic acid gas, which is mixed with the beer previously drawn from the fermenting tun, the charged liquid being then filled into barrels or kegs. An apparatus of special construction is provided for carrying out this process in a simple and economical manner, preventing any waste of gases during fermentation, and the liquid so filled is designed to keep almost any desired length of time without spoiling.

An improved liquid and gas mixing apparatus, of simple and durable construction, is so arranged that the moving column of liquid actuates the mechanism for completely mixing the gas with the liquid. A wheel driven by the column of liquid turns in a casing having an outlet or discharge pipe, a liquid supply pipe opening into the wheel at its center, and a gas supply pipe extending into the liquid supply pipe and discharging through it into the wheel.

The above inventions have also been patented by Mr. Werner in Great Britain, France, Germany, Belgium, and Austria.

Miscellaneous.

COMPUTING SCALE.—John H. Swihart, Dayton, Ohio. This is a scale which may be used in the ordinary way for ascertaining the weight of articles, and also be used to automatically compute the price to which certain weighed articles amount and the quantity of an article which may be given for a certain price. It comprises a tilting lever frame adapted to support the weight of the load, parallel connected scale beams fulcrumed near the free edge of the lever, and made to indicate price and weight, and an adjustable connection between one of the beams and the tilting lever frame.

WHEEL VEHICLE.—Thomas Hill, Jersey City, N. J. This improvement is especially applicable to dumping carts or wagons, as well as to various kinds of draught vehicles carrying persons or merchandise. The spring-carrying pedestals which support the body form integral parts of the main frame, and on the under side of the castings, of which the pedestals form a part, are recesses to receive the vehicle axle, U or clip-shaped bolts bracing and supporting the sides and body of the axle. The improvement is designed to insure lightness, durability, and strength, and easy or light running of the vehicle, free from rattle or shake.

LATCH.—Philip Steuerwald and Albert Cording, Saunemin, Ill. This is an improvement in door catches which have a pivoted catch proper, to which is pivoted a sliding rod, and a spring holding it normally engaged with a projection on the door or door casing. In the patented device the knob or part attached to the door has inwardly projecting arms to whose extremities a catch is pivoted whose free end swings across the base of the knob, and is thus adapted to enter a recess in the door casing to hold the door closed.

TONGS.—Thomas Smith, Breckenridge, Miss. Tongs especially designed for conveniently grappling and easily carrying ice, kegs, boxes, etc., are provided by this improvement, the construction being such that the article can be readily disengaged by simply changing the position of the tongs, to throw the weight on one of the legs only. A bar carrying the pivot of the tong legs or tines is formed with a bearing in which is fitted to slide the handle bar, pivotally connected by two sets of links with the tong legs.

BRIDGE FOR STRINGED INSTRUMENTS.—George Wooster, Fort Apache, Arizona Ter. This is an improvement for such instruments as the zither, guitar, mandolin, and others having a fretted key board. It consists of a bridge plate, an anchor plate, and string rests adjustable upon the bridge plate, with locking devices for clamping the rests to the plates, the string rests being equal in number to the number of strings, and each string having an independent locking device. As the strings for such instruments are of irregular size and elasticity, this can be allowed for by the improvement, and the rests may be adjusted to give a tense string a greater length than a lax one.

MUSICAL KEY AND TRANSPOSITION GUIDE.—J. B. F. Showalter, Valparaiso, Ind. Disks of thin wood or cardboard, bearing different characters on their opposite sides, are held on a shaft supported from a base, the central and larger disk having near its outer edge the natural and sharp keys of the different clefs on one side, and on the other side the natural and flat keys. Smaller disks on each side of the central one form indicator or pointer sections, while still smaller outside disks constitute minor accidental sections. By this means is formed a guide designed to quickly indicate the signature of any given key and the notes sharped or flatted in it, the designation of the major and relative minor and the accidental incident to the relative minor.

HAT BLOCKER AND STRETCHER.—Adin W. Hilsinger, Orange, N. J. According to this improvement, the grippers are capable of individual adjustment, whereby the hat body operated on will be held firmly by each gripper, instead of their adjustment being collectively made as heretofore. Combined with two pivoted bars having a loose connection at their upper ends, one bar carrying the lower jaw, overhung by the upper jaw sliding on the other bar, is a longitudinally extending adjusting screw connecting the upper jaw with its carrying bar.

BOX FASTENER.—Davis R. Knox, Portland, Mo. The box to which this device is applicable has a sliding lid or top, the box having an apertured locking end strip, and the sliding lid having a corresponding strip with a recess in which lies a crank-shaped vertically sliding and horizontally turning bolt adapted to engage the strips, and to turn a bent handle end out of the recess when the lid is unlocked. The fastening is cheap and easily operated, and entirely out of the way when the lid is closed.

CLOTHES DRIER.—George A. Leighton, Newaygo, Mich. This is an adjustable opening and folding rack, which is light, easily operated and adjusted, and presents a large amount of clothes room, while it also has an adjustable caster or roller base that facilitates the movement of the rack over the floor, gives a steady cross support, and may be folded when the rack is not in use.

RIFLE ATTACHMENT FOR SHOTGUNS.—William J. Redwine, Concordia, Kansas. This invention provides a barrel with a number of parallel bores to slip into a shotgun barrel, the bores to be rifled after the manner of an ordinary rifle, there being a spring-pressed ejector at the butt end of the barrel with bores registering with the barrel bores, and mechanism for exploding the cartridges. The attachment may be quickly inserted in the barrel of an ordinary breech loading shot gun, and affords means for firing one or a number of small bullets, and forming an arm which is a combined rifle and shotgun.

STOVE.—Albert W. Alger, Kansas City, Mo. A series of deflecting dampers is arranged within a cylindrical stove body closed at one end and open at the other, while a telescopic head section in which is arranged a burner fits the open end, the construction forming an improved oil stove whereby the radiation of heat is greatly increased, while a safe and convenient method is provided of feeding oil to the burner.

HUSKING PIN.—Svein M. Halvardsgaard, South Sioux Fall, South Dakota. This is a device with adjustable finger straps, and a plate or blade having at its forward end hollow bent claws. The improvement also includes an adjustable palm piece that protects the palm of the hand and gives increased strength to work and control the implement.

BAG HOLDER.—Thomas Merry, Chicago, Ill. This is a simple and efficient device for holding bags while they are being filled, and is formed of wire doubled upon itself to form a loop, with each arm of the loop offset or bent twice at right angles, the arms of the loop being connected at the free end with a looped wire, and means being provided for supporting the wire loop.

EYE SHADE.—Silas G. Soules and Horace E. Stowe, Hudson, Mass. A nose piece and two forwardly projecting trough-like shades are comprised in this device, the shades fitting close to the lower eyelids, so that no light can strike the eyes from underneath. A screen hangs down from the inner ends of the shades, and the device is more especially designed for the use of drivers of teams, engineers, etc., enabling the wearer to see more clearly ahead.

FAN.—Samuel H. Baer, Brooklyn, N. Y.—This is an improvement in that class of fans in which the web folds between two handles, and opens into circular form by swinging one handle section on a pivot connecting the handle sections. The outer folds of the web are secured on the handle sections by sheet metal L-shaped strips, which are not visible, but securely fasten the folds in place, and also inclose the body of the web and protect it from injury.

MAT.—Henry E. T. Gerhard, Mattapan, Mass. This is an improved article of manufacture, comprising a flexible waterproof base and a surface of overlapping scraps or strips, the base and scraps being secured together by rubber cement and vulcanized. The invention provides principally for utilizing the waste scraps of waterproof material produced in the manufacture of waterproof garments.

TRUSS.—John Gray, Buffalo, N. Y. This is a light and strong truss to be worn around the body for the treatment of hernia, and is adapted to carry the pad so that it may be held at an angle to the truss belt and at a convenient distance therefrom.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

APPLIED MECHANICS. By Andrew Jamieson. London: Charles Griffin & Co. 1892. Pp. xvi, 268. Price $1.25.

We here have a London University examination manual, covering a special stage of the science and art department examination in applied mechanics. Notwithstanding this fact, the well known author seems to have succeeded in producing an excellent manual. The work is also characterized by numerous illustrations and an unusually full index. In the illustration of the ship's capstan, of page 44, the arrows indicating the motion of the rope are put in the wrong direction.

COMMERCIAL ORGANIC ANALYSIS. By Alfred H. Allen. Vol. III. Part II. Philadelphia: P. Blakiston, Son & Co. 1892. Pp. viii, 584. Price $5.

Allen's Commercial Analysis has won so high a place in scientific literature, that any review of this last published portion is unnecessary. Criticism seems out of place in dealing with it. A reference to its contents shows the ground covered. Amines and ammonium bases, hydrazines, tar bases, such as aniline, pyridine, etc., and vegetable alkaloids are the subject matter of the present volume. The subjects are systematically treated. Thus under the cinchona alkaloids, the alkaloids are individually treated, their separation and the commercial assay of cinchona bark coming later. The commercial assay as executed in this city, while not given in detail, can be worked up very satisfactorily from the data given. We note also that the destruction by fermentation of cocaine in coca leaves is duly noted. This is a subject which has occasioned much trouble and dissatisfaction between importers and chemists. A very valuable feature is a plate of photo-reproductions of commercial leaves and leaves used as adulterants.

A TREATISE ON MORTGAGE INVESTMENTS. By Edward N. Darrow. Minneapolis: L. Kimball Printing Co. 1892. Pp. x, 50. Price $1.

This little manual is written for the public. It is arranged in the usual paragraph form of legal treatises, with full-faced caption for each paragraph. The range of subjects is excellent. Possibly the author's penchant for long sentences might be criticised. Clearness is everything in a law book, and short sentences generally conduce thereto.

ELECTRIC LIGHTING AND POWER DISTRIBUTION. By W. Perren Maycock. Part I. London: Whittaker & Co. New York agents, Macmillan & Co. No date. No index. Price 75 cents.

As we have noted in many other English science manuals, we again find the shadow of the London Institute examinations. It purports to be a really elementary work and as such will be acceptable to many American readers.

PHOTOGRAPHISCHES NOTIZ- UND NACHSCHLAGE-BUCH FUR DIE PRAXIS. Von Ludwig David und Charles Scolik. Third Edition. Halle a. S.: Wilhelm Knapp. 1893. Pp. xiv, 204.

This work, devoted to photographic notes, etc., for the amateur, is illustrated by seven most beautiful heliogravures, which in every way rival the best efforts of the artist and engraver. Otherwise it contains a useful amount of information and data as to platinotype and other processes, and a memorandum table for the entry of data concerning negatives.

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SCIENTIFIC AMERICAN

BUILDING EDITION.

FEBRUARY, 1893, NUMBER.—(No. 88.)

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2. Plate in colors showing a residence at Bridgeport, Conn. Two perspective views, one interior view and floor plans. Messrs. Longstaff & Hurd, architects, Bridgeport, Conn. An excellent design.
3. A model dwelling at Holyoke, Mass., erected at a cost of $6,000 complete. Perspective views and floor plans. H. W. Coolidge, architect, Holyoke. A pleasing design.
4. A cottage erected at Cranford, N. J., at a cost of $5,000. Floor plans, two perspective views, etc. F. W. Beall, architect, New York.
5. The First Baptist Church recently erected at Warberth Park, Pa., at a cost of $6,000. A unique design in the Gothic style of architecture.
6. A residence recently erected at Bridgeport, Conn., at a cost of $5,900 complete. A picturesque design. Perspective elevation and floor plans. Mr C. S. Beardsley, architect, Bridgeport.
7. An elegant residence recently erected at Newton Highlands, Mass. Perspective view and floor plans. Cost complete $6,472.
8. An attractive design for a suburban dwelling at Holyoke, Mass. Perspective elevation and floor plans. Messrs. Gardner, Pyne & Gardner, architects, Springfield, Mass.
9. A row of model dwelling houses on West Sixty-eighth Street, New York City. An exquisite design. Floor plans and perspective.
10. A cottage at St. David's, Pa., recently erected at a cost of $5,100 complete. Floor plans and perspective elevation. Messrs. F. L. & W. L. Price, architects, Philadelphia.
11. Views of the extensive red sandstone quarries at Potsdam, N. Y., together with views of various public and private residences built of Potsdam red sandstone.
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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.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(4666) W. N. asks what they put in the tumbling mills to smooth up broom handles. I want to make a mill for tumbling handles, and don't know what to put in to roll with them. A. Hard wood chips from a turning lathe or wood planer are best. Coarse hard wood sawdust may be used.

(4667) C. E. M., Arizona, writes: We have a number of barrels of cement that got wet in high water last spring. Do you know of any way that it can be fixed so it can be used again? Would like very much to know, as cement is a very expensive article in this country. A. You can only utilize the cement by reburning in a kiln and regrinding.

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January 31, 1893,

AND EACH BEARING THAT DATE.

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Oils and other wood-preserving compounds, P. H. Gerhard ... 22,396
Paints for roofs, etc., Mica Roofing Co ... 22,397
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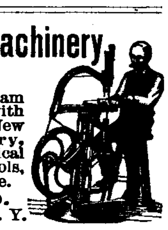

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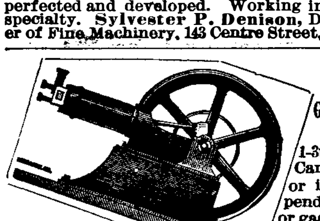

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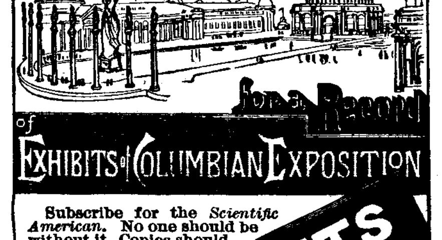

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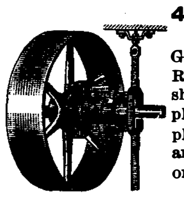

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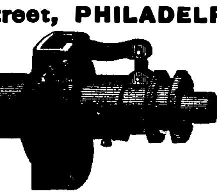

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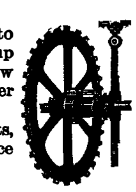

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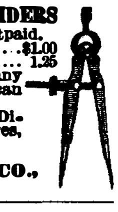

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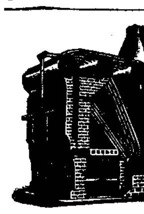

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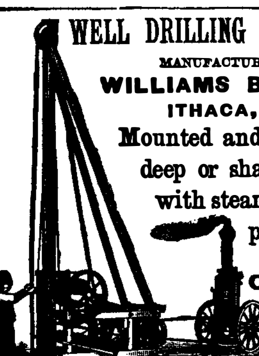

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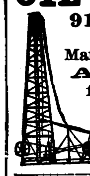

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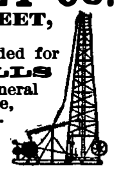

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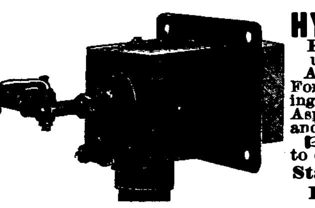

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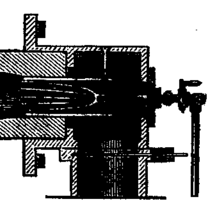

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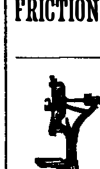

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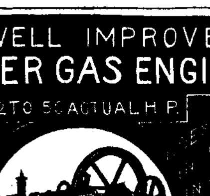

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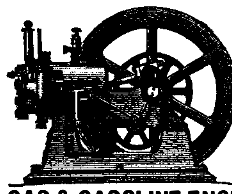

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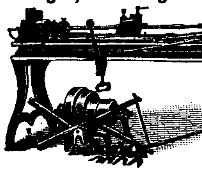

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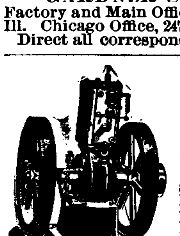

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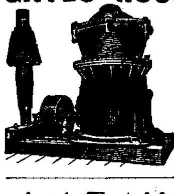

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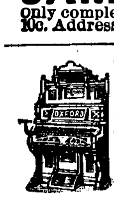

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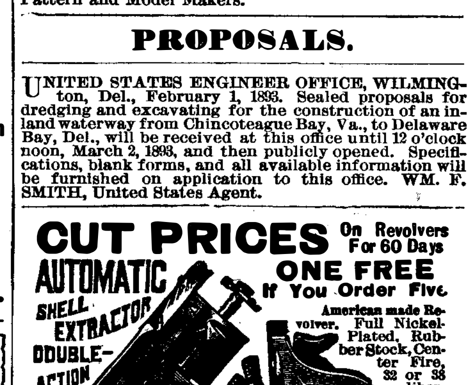

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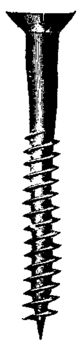

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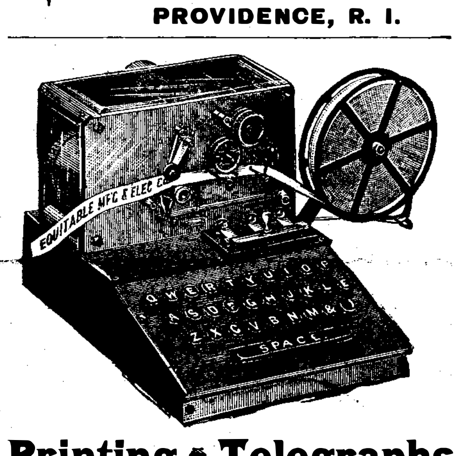

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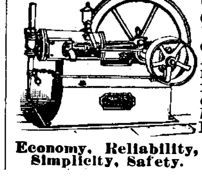

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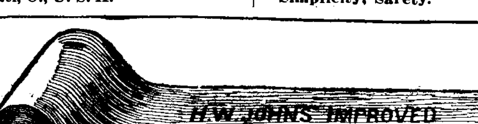

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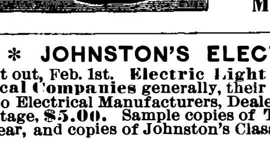

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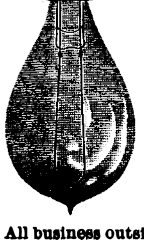

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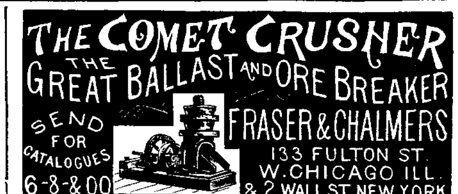

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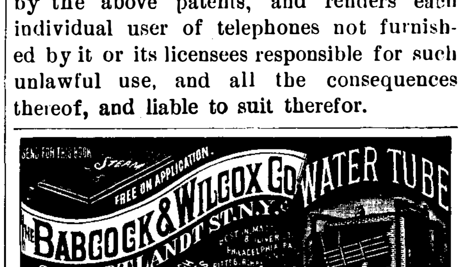

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