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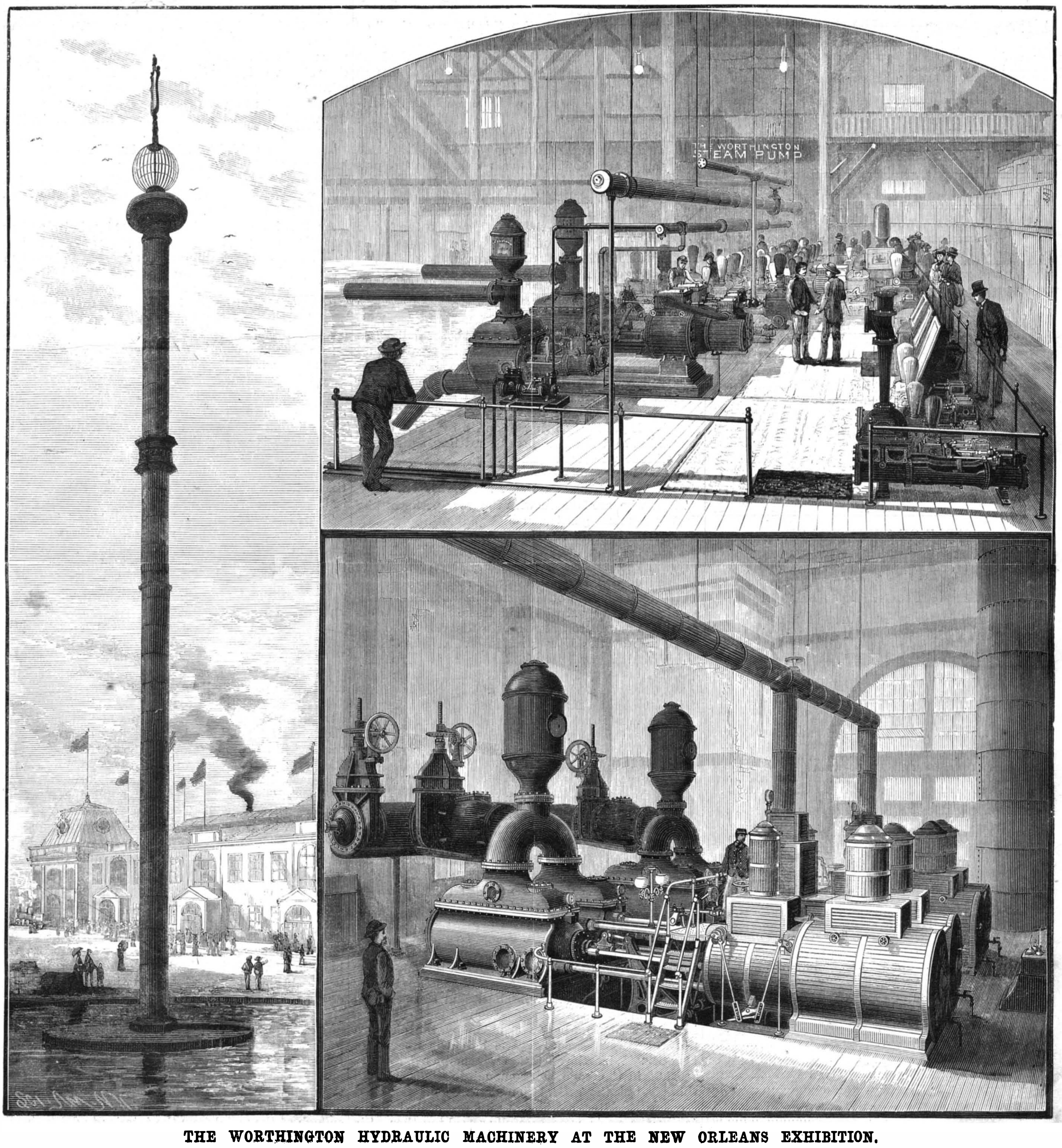
THE NEW ORLEANS EXPOSITION.

THE WORTHINGTON HYDRAULIC MACHINERY.

The steam actuated piston pump, although about contemporaneous with the piston steam engine, has a history forming a most interesting study from two points of view. Considered as a piece of mechanism, pure and simple, we can trace the changes which have gradually taken place during years past, the improvements which have been made, sometimes small and of seeming insignificance, and sometimes presenting innovations at the time thought to be in advance of the age, and even now viewed with admiration, but all being steps toward the ideal machine. Looking at this history from the other side, we can easily trace the causes which made necessary these improvements; in certain cases the demand was of a peculiar nature, and required treatment applicable solely to itself, while in other instances the pumps were designed to meet regular wants, and the improvements were the outgrowth of that natural desire, so freely implanted in the Yankee breast, to enhance the value by increasing the efficiency of the tools he possessed. The steam engine has been the prime cause of many of the most important inventions in pumping machinery; many of the industries have aided the advance by creating the want; systems of water-works, which now number nearly one thousand in this country, have required massive pumps of great capacity.

Yet one of the most important changes was brought about by the desire to transmit oil from the oil regions to distant points of consumption through lines of pipe. Here a new factor entered the problem. Generally, the pipe lines followed the contour of the country, descending valleys and passing over hills, and while gravity could be made subservient in some localities, the mere number of feet the oil was to be raised vertically presented a by no means difficult task; but when the pressure and friction resulting from many miles of length were taken together, the task set before the old style pump was one of tremendous magnitude. The problem of working against extreme pressures had not

(*Continued on page* 229.)



THE WORTHINGTON HYDRAULIC MACHINERY AT THE NEW ORLEANS EXHIBITION.

Scientific American.

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NEW YORK, SATURDAY, APRIL 11, 1885.

Contents.

(Illustrated articles are marked with an asterisk.)

Back for piano stools*............ 228
Battery, a cheap*............ 230
Bricks, glass sand............ 227
Business and personal............ 233
Cholera, pepper and salt for............ 225
Commissioner, the new............ 232
Construction from nature, suggestions for............ 227
Construction of vessels, improved*............ 230
Cow Mollie Garfield*............ 231
Cutting things under water............ 226
Dividers and calipers, improved............ 226
Engineer, locomotive, oldest............ 229
Exhibition, New Orleans............ 228
Fight for life*............ 231
Fire, extinguishing, mode of............ 232
Flower pot holder, wire*............ 228
Freight depot, a London............ 225
Gas, water, ruled out of Massachusetts............ 225
Gnat, buffalo, the............ 231
Gun, Maxim, the............ 227
Gun, 110-ton............ 229
Hair, gray............ 231
Hat as a camera obscura*............ 227
Hydraulic machinery, Worthington, at New Orleans Exposition*............ 223, 229
Inventions, agricultural............ 233
Inventions, engineering............ 233
Inventions, index of............ 235
Inventions, miscellaneous............ 235
Jack of all trades, the............ 224
Lead gaskets............ 232
Mechanics, artistic............ 224
New books and publications............ 233
Notes and queries............ 234, 235
Patentees fail to realize, why............ 225
Pencil marks, fixing............ 232
Pipe line across the Egyptian desert............ 229
Postmastership, New York............ 226
Powder, insect, toxic effect of............ 232
Power, transmission of, electrical............ 225
Protector for water pipes against freezing*............ 226
Pulleys, loose, improved............ 224
Rudder of the Alaska*............ 232
"Sun" column designed for lighting Paris*............ 230
Tempering process............ 225
Thill holder, improved*............ 226
Time check system, new............ 228
Time, decimal system of............ 228
Valve, reversing, for hoists, elevators, etc.*............ 227
Varnishes, colored, for tin............ 226
Vivisection, experiments in, recent............ 224
Waterworks on a small scale............ 226
Well, air, intermittent............ 232

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT,

No. 484,

For the Week Ending April 11, 1885.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ENGINEERING AND MECHANICS.—Bridge over the Blaauw Krantz Ravine, Cape Colony.—2 engravings............ 7719
Torpedo Ships............ 7719
The Gas Engine.—By DUGALD CLERK.—Combustion engines.—First cylinder and piston engine.—Watt's experiments.—First gas engine.—Principles of the gas engine............ 7720
Rapid Construction of the Canadian Pacific Railway.—By E. T. ABBOTT............ 7721
The Osgood Mammoth Excavator.—3 figures............ 7722
Capstan Navigation on the Volga.—4 figures............ 7722
Steamboat Equipment of War Vessels.—With engraving of winch for raising and lowering torpedo boats............ 7723
Improved Steam Trap.—1 engraving............ 7723

II. TECHNOLOGY.—Critical Methods of Detecting Errors in Plane Surfaces.—By JOHN A. BRASHEAR.—11 figures............ 7724
Photometric Standards.—9 figures............ 7726
Bleaching or Dyeing Yarns and Goods in Vacuo.—1 figure............ 7726
On the Moulding of Porcelain.—By CHAS. LAUTH.—Moulding by pressure of the air.—Moulding by vacuum.—Drying the moulded pieces.—2 figures............ 7726
Photo-Tricycle Apparatus.—1 figure............ 7727
A Photo Printing Light.—1 figure............ 7727
A New Actinometer............ 7727
Astronomical Photography............ 7728
Electricity as a Preventive of Scale in Boilers............ 7728

III. DECORATIVE ART.—Alphabet designed by Godfrey Sykes.—An engraving............ 7728
Old Wrought Iron Gate.—An engraving............ 7729

IV. GEOLOGY.—The Organization and Plan of the United States Geological Survey.—By J. W. POWELL.—A topographic map of the United States.—Paleontology.—Chemistry.—Physical researches.—Statistics.—Library.—Publications.—General geology.—Economic geology.—Relation of the general survey to the State survey............ 7732

V. BOTANY, ETC.—The Sunflowers.—Annuals, perennials, etc.—11 engravings............ 7732
Lye's Fuchsias.—1 engraving............ 7734

VI. HYGIENE, ETC.—Brief Sanitary Matters in Connection with Isolated Country Houses.—By E. W. BOWDITCH............ 7729
Sanitary Cooking.—By V. L. OPPENHEIMER............ 7730
Time required to digest Different Foods............ 7730

IMPROVED LOOSE PULLEYS.

Visiting the shop of a wideawake machinist, a short time ago, attention was attracted to a singular arrangement of pulleys. A special tool was driven by a belt from an overhead shaft on to a fast pulley of 10 inches diameter, by the side of which was a pulley of 9 inches diameter in the position of what would be the loose pulley. This smaller pulley was, indeed, the loose pulley, but it was not on the same shaft or arbor with the fast pulley. It was secured to a stud that had two bearings or journals on independent studs, so that the loose pulley and its stud had no connection with the fast pulley and its arbor. Its position in regard to the fast pulley was such that its rim and that of the fast pulley were exactly coincident at the point where the driving side of the belt "took" on the pulley face. Mechanics will readily understand the situation; of course, the opposite edge of the smaller or loose pulley's rim fell within that of the larger or fast pulley's rim by the difference in their respective diameters. Now, if the belt is shipped from the larger (fast) pulley to the smaller (loose) pulley, its tension is at once slackened, and the belt runs on the loose pulley with the least possible friction. And, when the belt is shipped from the small pulley to the larger pulley, the coincidence of the rims at the point of belt driving and the gradually increasing diameter of the running side of the pulleys induce the belt to climb up the larger diameter, just as a belt on the crowning faced pulley will seek the largest diameter.

It was surprising to notice this "encouraging" or "inviting" action when the belt was shipped from the small loose pulley to the fast larger pulley; the least impinging of the edge of the belt on the edge of the fast pulley sent it whirling across the face, so that the belt was seated apparently with a single revolution, starting the machine fully as quickly as it could have been done by a friction clutch, and without any shock or jar. The converse action of shifting to the smaller loose pulley appears to be just as easy as when the two pulleys are of the same diameter, the release or slackening of the belt being probably an inducing element.

The contriver of this arrangement claims that something of the readiness of the belt to engage the larger fast pulley is because of the higher velocity of the smaller loose pulley; but this seems hardly tenable, as the velocity of the belt is independent of the diameter of the receiving pulley. Yet there are advantages in this peculiar adaptation of the pulleys one to the other; the smaller loose pulley eases the tension on the belt, and its enforced independence of the other pulley is a good method to use in all cases where it is feasible; all loose pulleys should run on their own axes, and not loosely on a shaft, that is, loose pulleys should, when practicable, be mounted on journaled spindles—keyed on—so that the spindles turn with them. This better practice is gradually being adopted by enterprising machinists to replace the present rattling, squeaking, and oil-consuming arrangement.

RECENT EXPERIMENTS IN VIVISECTION.

Those who are familiar with the work performed by that estimable gentleman and philanthropist, Mr. Henry Bergh, cannot help listening attentively to what he has to say, and generally agreeing with him; but, at times, it seems as if his sympathy for the brute creation carried him to unwarranted excesses. To this latter category would seem to belong his action regarding the very valuable, and in no sense cruel, experiments in osteotomy recently made with an etherized sheep at the New York Post-Graduate College and Hospital. Suffering humanity has some claims that cannot be overlooked; and if investigations made by experts with living subjects will seem to lessen the pain or shorten the list of maladies that human flesh is heir to, it would appear unreasonable to demand their discontinuance.

The experiments referred to were made with a purpose of ascertaining whether or no bone may be removed in diseases of the joints without entailing permanent stiffness in the affected parts. The theory upon which Dr. Roberts' operation was based is that the first indications of disease in bone may be removed in much the same manner as that employed by dentists with decayed teeth, and that the well known property of bone to throw out new tissue would do for the part removed what the dentist's artificial filling does for the cavity that is left in the tooth.

When the sheep had been rendered insensible by the application of ether, Dr. Roberts removed the wool between the thigh and the shank, and then laid bare that portion of the bone which lies adjacent to the articulation of the joint. A small electric battery served to operate a drill and burr, and by means of these he made a small excavation in the bone, pausing from time to time to examine by the aid of a miniature incandescence electric light the progress of his work. When the operation was completed, a cavity was left in the bone large enough to admit a small thimble, but the articulation of the joint remained uninjured. After a drainage pipe was affixed to the cavity, the parts were carefully sewed together. Six weeks hence, when the cavity shall have had ample time to fill up with new bone, the animal will be killed, in order that the result of the operation may be accurately determined. Should the theory upon which this operation is based prove well founded, the most important results may be expected in the future treatment of diseases of the hip, knee, and ankle where the spongy interior of the bone is the seat of the trouble, and the slow and trying system of absorbing the diseased bone, of removing the joint and thus shortening the leg, and the other and various means employed, all of which leave a stiffened joint as a result, will be superseded.

It does not require unusual perception to distinguish between operations such as that described, related directly and specifically to the art of healing, and those with no more specific aim than the advancement of knowledge or, worse still, to illustrate the living organism or satisfy idle curiosity. Such practices as these latter have furnished good cause for complaint, and moved even those less sensitive than Mr. Bergh to protest in indignant tones against them. But there is a higher cause to which vivisection may be made to appeal—the cause of suffering humanity; and when so directed by competent hands, objections on the plea of cruelty seem to be at once unjust and illogical.

ARTISTIC MECHANICS.

A recent notice of a mechanic in Massachusetts who is an expert in that department of natural history of which the butterfly is the chief representative, suggests other and similar instances. It may be that the exactness required in mechanical work develops a taste for close study, or it may be that natural history and pure science become pleasant foils to the monotony of mechanical work; but it is the fact that some practical, day-working mechanics stand high in some scientific specialties.

There is a machinist—a fine tool maker—who is well known, and widely known, as an amateur astronomer. He has contributed importantly to the science, and is not surpassed in nicety and preciseness in designing astronomical mechanism.

Another is an expert steel engraver by choice and as a pastime, and yet, incredible as it may appear, he is a smith or forger, handling steel and iron in bars and the heavy hammer of the blacksmith all day, and doing delicate steel engraving at night or on "off hours." He has nearly finished designing and engraving a series of plates representing the childish legend of the "Death of Cock Robin," the proofs of which are really fine.

One left the machine shop three years ago, and set up as an engraver on jewelry, plate, and similar articles. He originates all his designs, and rarely makes a second drawing. He is a wonderful producer of elegant and legible monograms. A set of six silver buttons for a vest, all uniform in general design and no two alike in particulars, is very artistic, and yet he designed and engraved the six while the customer waited—perhaps an hour. These two instances show that the bent of the authors was naturally artistic rather than mechanical.

There is a young man, thirty years old, a joiner, who is better authority on the flora of New England than some of the authors of accepted text books. The fields, pastures, woods, and by-ways are his haunts when he has an hour "in the season." He is not surpassed as a herbalist, and is quoted as authority where he is known.

A surgeon was spoiled when another man, a machinist, went into the shop. He acts at call in setting bones and reducing sprains. He is so successful that he is in the confidence of the professionals, who are not ashamed to profit by his suggestions.

This mechanic, however, only carries to its ultimate a faculty and a practice that is not uncommon in the shops. It is rare, indeed, that in case of an ordinary accident in the shop there is necessity for outside aid. When the writer was a youngster, he lodged a piece of the sharp, hammer hardened head of a cold chisel in one eye. The "shop surgeon" applied a powerful magnet without avail. Then he cut out the obtrusive particle with a keen penknife blade, making an incision just as he might in a finger. A professional surgeon who afterward examined the eye said that it was a "very creditable job."

THE JACK OF ALL TRADES.

In the shop of one of these men was noticed, recently, some articles sent for repair; curiosity prompted a list of some of them. There were two parasols, the handles of which were broken, one requiring inlaying with gold and silver in plates and wires; several clocks, one an antique musical timepiece marked "Jans Heerch, Haarlaem 1692;" a musical box with a capacity of eight tunes; a seated statuette of Clio, the muse of history, one of whose legs had been broken off. This figure was made of cast zinc, externally bronzed, as most of our foreign "bronze" statuettes are made, and the shell was very thin—not more than one-sixteenth of an inch thick. For this job the mechanic scraped enough of the metal from the interior to determine its quality, and then made a solder to correspond. As it was manifestly impossible to hand-solder inside or outside the broken limb, which was not more than half an inch diameter, the workman secured the broken parts in place by wire and twine, drilled a concealed hole on the under side, poured in the hot metal, turned the image in his hand for a moment, and the job was done. The flux and fusible metal formed a metallic coating inside the leg, and effectually repaired the damage.

The method employed in this job was only a modification of that used extensively in the manufacture of soft metal wares, as Britannia and silver plated articles. The handles of Britannia teapots, for instance, are cast hollow, but they have no removable sand and rye flour cores, as castings of iron and brass have. These and a hundred other pieces of soft and quick cooling metals are cast in brass moulds, only a sufficient amount of melted fluid metal being poured in to make a thin shell. This metal is equally distributed by turning and shaking the mould in the hand, when it chills, and the superfluous metal is poured out. The doing of this work is a trick, but this competent mechanic was equal to it in the case of a difficult job.

He had on hand, also, musical instruments, drums, cornets, a trombone, an ophicleide, an oboe, and a sewing machine, and an old fashioned spinning wheel, intended to soothe the æsthetic rage of some admirer of antiques. On particular inquiry, this mechanic served four years as a machinist, worked one year in an iron foundry where brass was also cast, became a pattern maker, a decorator, and letterer of railroad passenger cars, worked nearly a year in a gun making establishment, and taught himself engraving and the setting of precious stones, spending several months in the shop of a practical jeweler. In all, he had worked fifteen years for others, and then set up a general utility shop for himself. While he does every job that he undertakes well, he has some special gifts. He is the master model maker of his part of the country, and probably possesses a larger number of inventors' secrets than most men in his line. If there is a particularly nice job of steel tempering to be done, it generally comes to his hand, and leaves it properly completed.

WATER GAS RULED OUT OF MASSACHUSETTS.

The investigation of the illuminant known as water gas, begun some time since by the Massachusetts Board of Health, is now completed, and the report submitted to the legislature. It will not surprise those who are conversant with similar investigations made long since in Europe, to hear that in the present report the use of water gas as an illuminant is strongly condemned. The reason for this condemnation is that a large quantity of carbonic oxide—30 per cent against 7 per cent in coal gas—is left in the product of the process for converting steam into gas by its exposure to incandescent anthracite. This carbonic oxide is, as we know, a deadly poison, and has been found to kill as surely, if not as quickly, as hydrocyanic acid.

In the experiments with animals, the escape of a very small quantity in a closed chamber brought stupor and unconsciousness, and only a little more, death, whereas with coal gas a much larger percentage produced only a condition of lethargy from which the animals were readily roused.

One of the most dangerous properties of water gas is that, being odorless, it is difficult and at times impossible to detect its escape. The animals that were exposed to its influence during the recent investigations passed quickly and motionless from one stage to another until death came. This shows the painless character of the lethal process and the insidious dangers of the gas.

The use of water gas as an illuminant originated in France, but so great was the loss of life which it occasioned that the municipality of Paris, after careful investigation, forbade its use. Yet it is the same process (Tessie de Motay) which is now used here in New York, and which certain persons sought to introduce in Boston. In the report of Chairman Pelouse, of the Municipal Council of Paris, which the Massachusetts Investigating Committee will find to coincide in many details with their own, appears the following: "It was proved that a mixture of one per cent of oxide of carbon killed a strong dog in a minute and a half. It was a case of poisoning. With one per cent of oxide of carbon, all animals died at the end of a few minutes. These experiments terrified me. Since then they have been repeated many times by men of science. Carbonic acid must not be confounded with oxide of carbon. In the course of the experiments of which I have just spoken, I formed an artificial atmosphere with thirty per cent carbonic acid. A large dog, on being placed in it, almost immediately fell on his side, but recovered himself on being restored to the pure air. Thirty per cent of carbonic acid did not kill; but, on the contrary, one per cent of carbonic oxide is mortal."

But this same water gas which has been ruled out of France, and which an investigating committee, made up of scientists, boldly proclaims as too poisonous and deadly to be permitted to enter Massachusetts, is now and has for a long time been in use in portions of New York city and Brooklyn.

A London Freight Depot.

In order to provide for the reception, delivery, and warehousing of both import and export goods from and for the new docks, the London, Tilbury, and Southend Railway Company are now building, says the *London Railway News*, a goods depot and range of warehouses in Whitechapel, which, when completed, will rank among the most important of similar undertakings to be found in England. The area occupied by the goods station is about eight acres, and the cost of acquiring the property has alone amounted to the respectable sum of £420,000. As the Blackwell Railway runs on a viaduct about seventeen feet above the streets, the whole of this area has had to be covered with an arrangement of arches to bring the new depot up to the same level; the road approaches from the main entrance in Commercial Road, being made on an incline of one in thirty to the level of the station. The covered portion, or goods station proper, will be 600 feet long by 200 feet wide, and will be occupied by five lines of rails, three platforms 20 feet wide, and three cart roadways, each 30 feet wide, running the whole length of the building. Over this station, and carried by cast iron columns 2 feet 6 inches in diameter and a network of steel girders, a warehouse, four stories high, will be constructed for the exclusive use of the East and West India Dock Company. The available floor space in this warehouse will be about twelve acres. There will be twenty-five hydraulic cranes on the platforms in the station; and twenty-four hydraulic lifts, each capable of carrying two tons, will convey goods direct from the platforms to either floor of the warehouse above. By these means the unloading and warehousing of a whole train load of goods from the docks will be accomplished in a very short space of time. At the south end of the station a hydraulic crane, capable of lifting twenty tons, will be fixed for loading and unloading heavy machinery, etc., and the whole of the shunting will be done by hydraulic capstans fixed in convenient positions. The warehouses will be fireproof, the floors being carried on steel girders amounting in the aggregate to about 8,000 tons in weight. In order to insure the stability of this enormous structure, the foundations have been carried down into the London clay about 24 feet below the surface, and are constructed of Portland cement concrete, the piers carrying the main girders being built in blue Staffordshire bricks to the top of the building. On the lower or street level the arching has been so arranged that rails, platforms, etc., can be laid down, and there will consequently be two large railway depots, one above the other, over the whole area, the upper and lower stories being connected by hydraulic lifts for the lowering and raising of the railway trucks. In addition to the buildings which they are erecting for the dock company, the railway company has purchased a large range of warehouses abutting on the new works, for their general business.

Electrical Transmission of Power.

M. Cornu has reported on the experiments made on March 4, 1883, at the works of the French Northern Railway, as to the application of M. Deprez's dynamos to the transmission of power along a telegraph wire. The generating machine (a Deprez No. 20) was connected with the receiver (a D Gramme machine transformed) on one side by a short wire of but little resistance, and on the other by a 4 mm. galvanized iron telegraph wire, 17 kilometers = 10½ miles long, passing through the Bourget station. These conditions, although not identical with those which are usual in the electrical transmission of power, did not appear to the commission sufficient to detract from the value of the experiments, as continuous and not alternating currents were employed. The results of the measurements are of two kinds—dynamometric, relating to the power transmitted; and electric, relating to the electromotive force developed in the generating and receiving machines. The following are the principal conclusions deduced from the tables of dynamometric and electrical results which were obtained:

"The work absorbed by the generating and transmitted to the receiving machine increased with the speed of the generator, attaining 4½ horse power for a speed of 1,024 revolutions, against an effective resistance of 160 ohms, representing a double telegraph line 8½ kilometers, or 5 miles, long. The gross yield amounted to as much as 37½ per cent of the work expended; and, if the mechanical motor be allowed for, so as to arrive at the result produced by the successive transformations of energy, the dynamometric result even reached 48 per cent. The table of electrical results shows that the telegraph line practically offered, while the power was being transmitted, that is to say with a current of 2½ amperes, the resistance of 160 ohms, which was recorded with a current of 0·01 ampere during the former experiments. This observation appears to sufficiently establish the agreement of theory and practice so far as concerns an analysis of the phenomena of transformation of energy in the circuit."

General Anson Stager.

General Anson Stager, the well known electrician, died in Chicago, March 26, within a month of being 66 years of age. He entered the telegraph business as a young man, taking charge of the first office in Lancaster, Pa., in 1846, and being successively removed, as the most capable operator, to Pittsburg, and then to Cincinnati, as the telegraph was extended to these places. He devised several valuable improvements in the service, and, on the organization of the Western Union Telegraph Company, in 1856, became its general superintendent. When the rebellion broke out, in 1861, it became apparent that a great military telegraph system would be necessary, and Gen. Stager was appointed to organize and superintend a department for that purpose, Thomas T. Eckert and Albert J. Myer being among his assistants. A special cipher code was originated, which, it was claimed, was never deciphered or betrayed; 15,000 miles of line were built and operated, and it is estimated that over 6,000,000 messages were sent by this military telegraph. After the war General Stager became superintendent of the central division of the Western Union Telegraph Company, but he resigned in 1880, and became prominently interested in telephone systems, electric lighting, etc., having been, until the commencement of this year, the president of the Western Electric Manufacturing Company, one of the largest establishments of the kind in the country.

Why Patentees Fail to Realize.

A gentleman in Texas obtained letters patent something over three years ago for an improvement in lock nuts, his invention being peculiarly adapted to the requirements of railroads, and, further, it had the heartiest indorsement of men practical in railroad construction and operation; more than this, their indorsement took practical form, and a number of them associated together and offered to provide the necessary capital to manufacture, and introduce it, agreeing to turn over to the inventor within a period of five years the sum of fifty thousand dollars, meantime permitting him to draw against said amount in reasonable sums. The inventor, however, had made a mental calculation of the many thousands of miles of railroad in the country, figured up the number of rail joints where lock nuts might be utilized, and, determined that no one should "play him for a sucker," placed his value at one hundred thousand dollars, one half cash down. This effectually closed negotiations, and he has his letters patent still, and retains his job in a machine shop.—*The Milling World.*

The experience of the Texas gentleman is not unlike that which has ended a great many negotiations which have come to our knowledge. Inventors are too apt to overestimate the cash value of their patents and let favorable chances for disposing of them slip by, while they are stopping to calculate the profits which will accrue to them when the improved article becomes universally adopted.

It is not wise to refuse a fair offer if the patent is for sale. It is unwise to repel a purchaser by demanding unreasonable conditions, and yet the price should not be put so low as to lead the would be purchaser to undervalue the invention. As in other matters, it requires considerable business tact to manage the sale of a patent to the best advantage.—ED.

Tempering Process.

Mr. P. Gabriel gives the following new method of tempering steel, in the *Revue Chronometrique.* Cyanide of potassium is dissolved and red heated in a metallic or earthen crucible; the pieces of steel are then immersed in the liquid until red, and afterward plunged in water. This process is said to give great satisfaction, and many advantages are claimed for it. The temper is said to be harder, and if a finished piece is under treatment, the polish is not lost. It will show a grayish tint, but the original polish will reappear immediately, if a piece of polishing wood with the finest rouge is passed over it. It is also said that if the steel has been well annealed, and not put out of shape by the file or the hammer, it will come from the crucible perfectly straight; arbors 4 or 5 centimeters long are not deformed, if tempered by this method. It is recommended as particularly advantageous for tempering escapement springs.

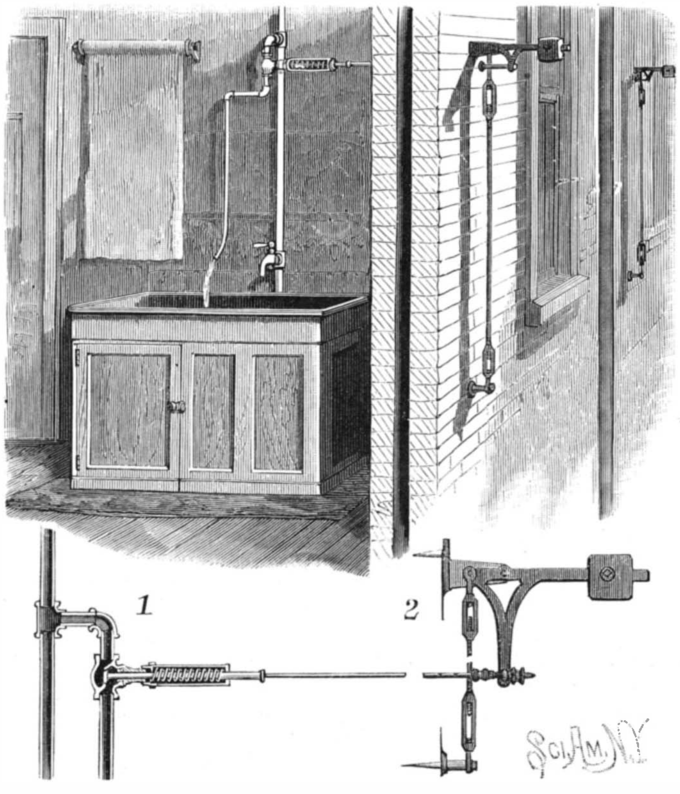
Red Pepper and Salt for Cholera.

A Massachusetts correspondent calls our attention to the publication, about thirty years ago, of a very successful cholera cure, introduced in this way: The captain of an emigrant ship, coming from Europe, had lost many of his passengers by cholera, although freely dosing all who were sick with the remedies then usual. At last he made a prescription of his own—one teaspoonful of red pepper and a tablespoonful of salt to a half pint of boiling water; this to be given as hot as possible, to every patient when first taken. It is said that this simple remedy acted as a charm, curing all the cases on board that ship, and attaining considerable general popularity during the time of that cholera visitation.

PROTECTOR FOR WATER PIPES AGAINST FREEZING.

The device herewith illustrated, designed to protect pipes against injury from the freezing of the water in them, is founded upon the fact that water in motion will remain liquid at a lower temperature than water at rest. One end of a copper rod, placed outside of the building, is secured to a bracket, and the other end is attached to one arm of a weighted elbow lever. To the other arm of the lever is secured a rod, which passes into the building and operates a valve in the water pipe. The arrangement of the parts is shown in Fig. 2. By means of turn buckles the length of the copper rod can be adjusted so that, before the temperature reaches the point at which there would be danger of the water in the pipes freezing, the valve will be opened to allow a flow of water; beyond this point the valve opening will increase and the flow become more rapid as the cold becomes more intense. As the temperature rises, the valve is closed. This plan sets up a current in the pipes, which replaces the water as it grows cold by the warmer water from the main. Whether the valve be opened or closed, the service pipes are always in working order. Certain conditions govern the location of the valve; when the danger from the frost is in the cellar only, the valve is put in any convenient position above, thereby establishing a flow through the cellar pipes. If the whole system of pipes in a building is liable to be frozen, the valve is placed at the extremity, and all branches are connected to that point, so that the opening of the valve will create a flow through all the pipes.

It is apparent that, owing to height of lower arm of elbow lever, a very slight change in length of rod will effect the opening or shutting of valve.



PROTECTOR FOR WATER PIPES AGAINST FREEZING.

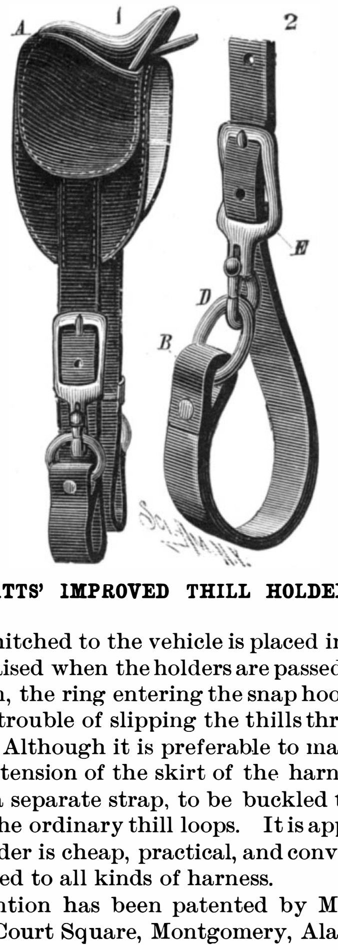
Cutting Things under Water.

When science was in its infancy, much of its fact was mixed with nonsense, and some of the nonsense shows a wonderful vitality. A case in point is the recent republication of a nonsense bit that was current at least forty years ago. It is a recipe for cutting glass with shears or scissors. The statement is that sheet glass can be cut with the greatest ease with a pair of scissors if the glass is kept under water and kept in a level position. That there is not a word of truth in it any one may easily prove on a trial, with the result of dulling a pair of shears.

There is one cutting process that can be better done under water than out of water; that is, the paring of onions. When pared under water the acrid emanations, so unpleasant to the mucous membrane of eyes and nose, are dissolved or held in the water. But neither the quality of glass nor the power of scissors is changed by immersion in water.

IMPROVED THILL HOLDER.

The engraving shows a thill holder, the object of which is to facilitate the work of hitching horses to one-horse vehicles. The holder is a plain strap of suitable length, to be wrapped around the thill, and provided at its outer end, B, with a ring, D. The ring is adapted to be held by a snap hook formed upon the lower end of a buckle, the tongue of which enters one of a series of holes formed in the strap. In use, the horse to be hitched to the vehicle is placed in the thills, which are raised when the holders are passed under and around them, the ring entering the snap hook. In this manner the trouble of slipping the thills through loops is avoided. Although it is preferable to make the thill holder an extension of the skirt of the harness, it may be made of a separate strap, to be buckled to the skirt in place of the ordinary thill loops. It is apparent that the thill holder is cheap, practical, and convenient, and can be applied to all kinds of harness.



WATTS' IMPROVED THILL HOLDER.

This invention has been patented by Mr. John W. Watts, of 4 Court Square, Montgomery, Ala.

Waterworks on a Small Scale.

The following entertaining account of a primitive but useful waterworks system is taken from *Engineering News*:

The smallest waterworks with which we have, in our researches, become acquainted is at Drewsville, N. H., about four miles from Bellows Falls, Vt. The village consists of a single line of houses built around the four sides of a small "common," of about two acres in extent. The population is 79; the school attendance is 13. It is the home of one of the present proprietors of the Fifth Avenue Hotel, New York city, and from its diminutive precincts have also come several other parties well known in religious, musical, and commercial circles in Chicago and New York. Our family found it a pleasant and healthful place to spend the summer months in on account of its pure mountain air, delightful drives amid lovely scenery, agreeable neighborhood, and its general healthfulness. The houses are supplied with pure and wholesome water, which is brought in wood pipes from a hillside spring a distance of half a mile. The Drewsville Water Company is eighty years in existence, some of the original log pipes being still in use. There are ten shareholders. A small circular wooden well house, 6 feet in diameter by about the same height, is the only structure belonging to the works. Inside this, a pile of stones without mortar is built up to sustain the "reservoir," a wooden box, 2′ x 3′ and 2 feet deep, divided into compartments proportioned to the number of shares owned by individual takers, each share being represented by a small auger hole, which allows the water to run from the common compartment into individual compartments and thence to the distribution pipes. If a "portion" of water is leased by any individual to a neighbor, it is gauged by the stem of a common clay pipe, which is the unit of measurement.

The little community is absolutely dependent on this water supply for domestic purposes. No other source of supply has been discovered, and if a "portion" cannot be obtained from a shareholder, there is no alternative but to move to some other place where water is more accessible. In 1876 new wood pipe for about the whole half mile was laid, and a new well house built, at a total expense of $282.91, which represents about the cost of maintenance of the Drewsville waterworks for three-quarters of a century. The treasurer and superintendent of the company is Mr. E. C. Bond, the village postmaster and storekeeper. The principal duty of the office is to provide a safe and convenient place to hang the key of the well house.

The New York Postmastership.

President Cleveland, in reappointing Mr. Henry G. Pearson to continue as Postmaster in this city for the ensuing four years, has given general satisfaction to the non-partisan but business portion of the community. Mr. Pearson has been in the office almost continuously from his first entrance, in one of the lowest positions, in 1860; he became its chief in the natural order of promotion, and has been foremost in perfecting the admirable system on which its business is conducted, so that he easily obtained the unqualified support of the business community for his maintenance in a position which he has filled neither as a Democrat nor as a Republican, but as a "business man," acceptable to the business community of the metropolitan city of this continent.

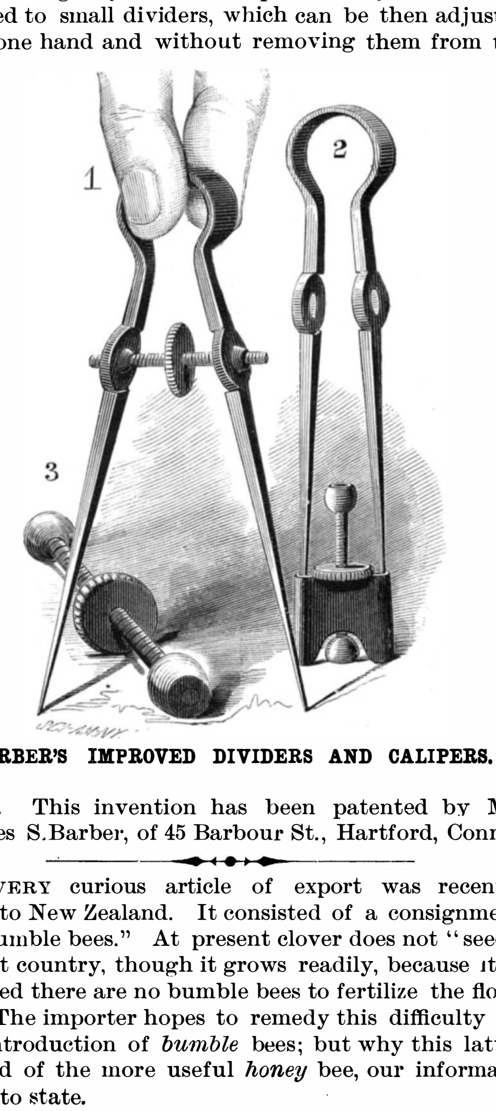
Colored Varnishes for Tin.

Thirty grammes of acetate of copper are ground into a fine powder in a mortar, then spread out in a thin layer on a porcelain plate, and left for a few days in a moderately warm place. By this time the water of crystallization, and most of the acetic acid, will have escaped. The light brown powder that is left is triturated with some oil of turpentine in a mortar, and then stirred into 100 grammes of fine fatty copal varnish warmed to 75° C. If the acetate of copper is exceedingly fine, the greater part of it will dissolve by a quarter hour's stirring. The varnish is then put in a glass bottle and placed for a few days in a warm place, shaking frequently. The small quantity of acetate of copper that settles can be used in making the next lot. This varnish is dark green, but when applied to tin it requires four or five coats to get a fine luster; but two coats are sufficient if heated in a drying closet or on a uniformly heated plate, to produce a great variety of shades of gold. A greenish gold, a yellow of dark yellow gold, then an orange, and finally a reddish-brown shade, are obtained, according to time and temperature. The colors are superior in brilliancy to those obtained with the English gold varnishes, and have the advantage of permanence in the light. If a good copal varnish is used in making this polychromatic varnish or lac, the tin can be hammered or pressed. The production of golden colors depends on the reduction of cupric oxide to cuprous oxide (protoxide to suboxide), which, in small quantities, dissolves in the copal varnish with a golden color. The more the heat, the greater the reduction, and hence the darker the color. Success depends upon applying it evenly and warming uniformly.

IMPROVED DIVIDERS AND CALIPERS.

The legs of the divider are united at the upper ends by a spring, and each is provided, at about one-third of its length from the upper end, with a widened part having a central circular aperture, the edges of which are made concave transversely. In each aperture a spherical nut is placed from the outside; extending through the nuts are the ends of a screw having right and left threads, and having a milled disk at the middle. The spring presses the legs from each other, and this exerts sufficient outward pressure against the nuts to hold them in place by friction and prevent their turning. By turning the milled disk in one direction or the other, the legs will be separated or brought together. When the dividers are to be folded for transportation, the screw is turned out of the nuts and withdrawn from the legs, the points of which are placed in a case, Fig. 2, to protect them, and the nuts are placed on the ends of the screw, which is placed in the case, between the legs, as shown.

The improvement can be worked entirely with one hand, the legs can be rapidly brought together or separated, and a stronger spring can be used, thereby giving more rigidity. It will be particularly useful when applied to small dividers, which can be then adjusted with one hand and without removing them from the paper. This invention has been patented by Mr. Charles S. Barber, of 45 Barbour St., Hartford, Conn.



BARBER'S IMPROVED DIVIDERS AND CALIPERS.

A VERY curious article of export was recently made to New Zealand. It consisted of a consignment of "bumble bees." At present clover does not "seed" in that country, though it grows readily, because it is believed there are no bumble bees to fertilize the flowers. The importer hopes to remedy this difficulty by the introduction of *bumble* bees; but why this latter instead of the more useful *honey* bee, our informant omits to state.

REVERSING VALVE FOR HOISTS, ELEVATORS, ETC.

Fig. 1 is a plan view, the valve and its casing being in section, of the engine cylinders, Fig. 2 is a side elevation and section of the same, and Fig. 3 shows the valve used in single engines. Each cylinder has the usual ports connecting with its opposite ends, and controlled by a suitable valve in the usual manner. Arranged midway between these cylinders is the reversing valve, of conical shape, but the taper being only sufficient to admit of its being ground to a good fit. The valve is fitted to work within a case directly connecting the two cylinders; this arrangement serves to brace the cylinders and to make the whole simple and easy of access. The valve is divided longitudinally into two compartments by a central partition, as clearly indicated in Figs. 1 and 2, which also show the ports and the steam and exhaust pipes. One of the ports formed by the partition serves to pass steam to, and the other to exhaust steam from, the engine cylinder valves.

At one end of the valve is a set screw, passing through the end cap of the casing, and a lock nut by which the valve can be adjusted. Steam pressure serves to keep the valve seated; and when steam is down, the valve is seated by a spring on the reversing spindle on the outside of the casing. Placed on this spindle is an arm by which the valve is shifted. The spindle is not secured to the valve, so that the latter may be removed whenever necessary by simply taking off the end cap of the casing.

When the valve is in the position shown in Fig. 2, the ports leading to the cylinder valves are closed; it will be readily perceived that the steam can be admitted to either side of the piston by turning the valve in one or the other direction. It will also be seen that the passage for live steam for one direction in the motion of the engine becomes the exhaust passage in an opposite moving direction of the engine, and *vice versa*. In Fig. 3 is shown a valve designed for single cylinder engines; the arrangement of the ports is clearly shown. The engine can be controlled from a distance by means of a rope or wire connected with the reversing lever; this method is especially advantageous when the engine is applied to work an elevator. This invention has been patented by Mr. E. L. Moore, and particulars can be obtained from Messrs. Moore Brothers, of Portsmouth, Ohio.

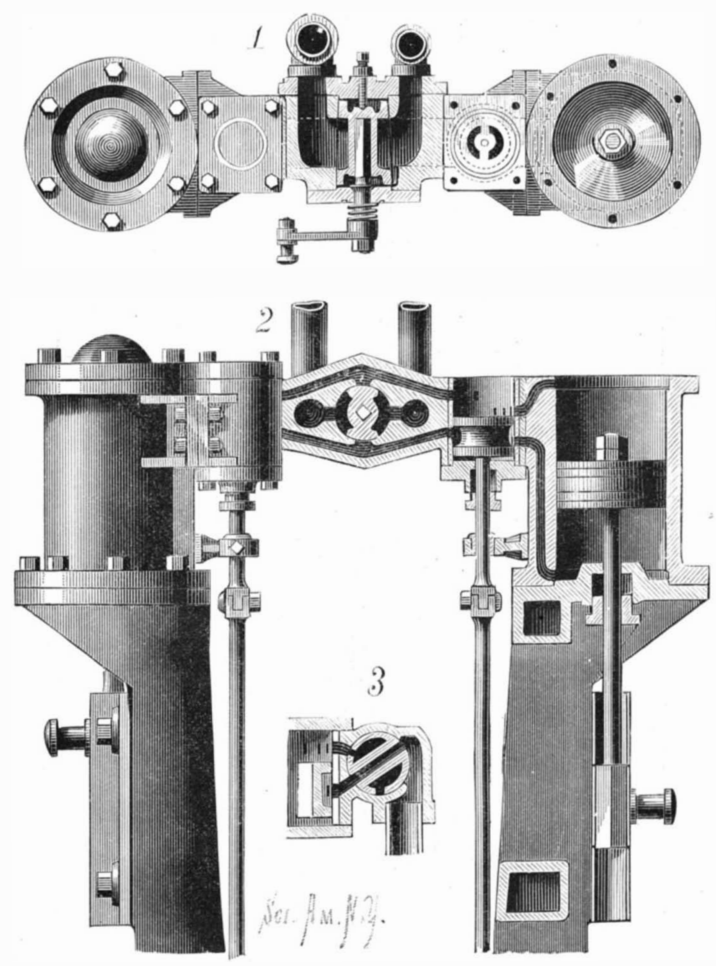
Suggestions for Construction from Nature.

PROFESSOR COCKERELL, R.A.

Sir Christopher Wren reflected that the hollow spire which he had seen or built in so many varieties was, after all, but an infirm structure, and he sought that model which should enable him to impart to it the utmost solidity and duration. Simple was the original from which he adopted his idea. He found that the delicate shell called *turretella*, though extremely long and liable to fracture from its base to its apex by the action of the water amid the rocks, was rendered impregnable by the central column, or newel, round which the spiral turned. Therefore, in his spire of St. Bride's, he establishes the *columella* in the center, round which he forms a spiral staircase to the top issuing on stages of arched apertures, thus giving us (if not the most beautiful) certainly the most remarkable and enduring spire hitherto erected. When Brunelleschi was charged with the erection of the dome of Sta. Maria at Florence, of nearly equal diameter with that of the Pantheon, but at more than twice its height from the pavement, upon a base raised on piers, and by no means of the strength and cohesion of the original model—the Pantheon—it was apparent that in giving it the same solidity, the weight would be insupportable on such a foundation. How was this object to be accomplished? Brunelleschi reflected that the bones of animals, especially of birds, possessed solidity without weight, by the double crust or hollow within. But, above all, he remarked that the dome which completes the architecture of the human form divine was constructed with a double plate connected by the light and fibrous but firm walls of the hollow *cancelli*, so that strength and lightness were combined in the utmost degree. Brunelleschi followed this model in his dome of Sta. Maria, and the traveler now ascends to the lantern between the two crusts of plates forming the inner and outer domes. Michel Angelo adopted this contrivance in the dome of St. Peter's, and almost all the subsequent domes are upon the same idea.

Glass Sand Bricks.

M. Hignette describes a new ceramic product from the waste sands of glass factories, which often accumulate in large quantities, so as to occasion great embarrassment. The sand is subjected to an immense hydraulic pressure, and then baked in furnaces at a high temperature, so as to produce blocks of various forms and dimensions, of a uniform white color, which are composed of almost pure silex. The crushing load is from 370 to 450 kg. per square centimeter (between 2 and 3 tons per square inch). The bricks, when plunged in chlorhydric and sulphuric acid, show no trace of alteration. The product has remarkable solidity and tenacity; it is not affected by the heaviest frosts or by the action of sun or rain; its resists very high temperatures, provided no flux is present; it is very light, its specific gravity being only 1·5; and it is of a fine white color, which will make it sought for many architectural effects in combination with bricks or stones of other colors.



MOORE'S REVERSING VALVE FOR HOISTS, ELEVATORS, ETC.

The Maxim Gun.

At a recent meeting of the Society of Arts, London, Mr. Hiram Maxim described at some length the construction, and showed the mode of working his patent gun. He said the complication to which the reader of the paper had alluded was not a necessary part of the gun; it might have been made to load and fire itself without so much complication; but these complications were introduced in order to allow of the magazine for the cartridges being placed under the gun instead of over it, where it was more exposed, and of its continuing to fire automatically with no attention beyond that of one man who directed the fire.

Some other guns required two men to put the cartridges in at the top, and one to turn the crank for firing, and another to turn the gun about, which made the motion very slow, the cartridges falling into their place by the action of gravity. In this gun they were arranged in a belt from which they were taken one by one, and a belt might be made to hold 2,000, if necessary. The speed was adjustable by the trigger, and could be made as high as 600 per minute. The gun could be adjusted so as to have a horizontal fixed range between two points, and thus, if works destroyed in the day were repaired by the enemy in the night, the bearings and levels could be taken in the daytime, and fixed, and at night the gun could be kept firing between these two points all night, by simply a boy to move it slowly from side to side; and he should not be surprised to find that the boy, like the one they had heard of, had devised some plan for making the gun do this automatically.

There was such beautiful adjustment in every direction, that you could easily write your name on a screen with it. Having described the means by which the recoil from each shot was utilized to extract the empty cartridge case, Mr. Maxim concluded by saying that when once put into work, the gun would go on firing, if desired, until the man who paid for the cartridges was in a hopeless state of bankruptcy.

THE HAT AS A CAMERA OBSCURA.

Take a Derby hat and close the ventilating apertures at the sides, if it have any, and remove the wire gauze from the ventilator in the top (Fig. 1, No. 1). Next, cut an oval piece, equal to B C, out of a sheet of tracing cloth or translucent paper, and fix it to the brim by means of drawing pins (Fig. 1, No. 2). This screen should be slightly oiled, so as to make it transparent.

Next, having provided yourself with a cloak, wrapper, tablecloth, or something of the kind as a photographic veil, go to the window and point your objective (the ventilator) at any brilliantly lighted object.

If your head be inclosed in the improvised veil in such a way that your hat is also surrounded as completely as possible by its folds, you will see a reversed and reduced image of the object appear upon the screen. In a word, you will have a practical apparatus for demonstration which is analogous to the camera obscura, and which may be used at home or during a promenade (Fig. 1, No. 3).

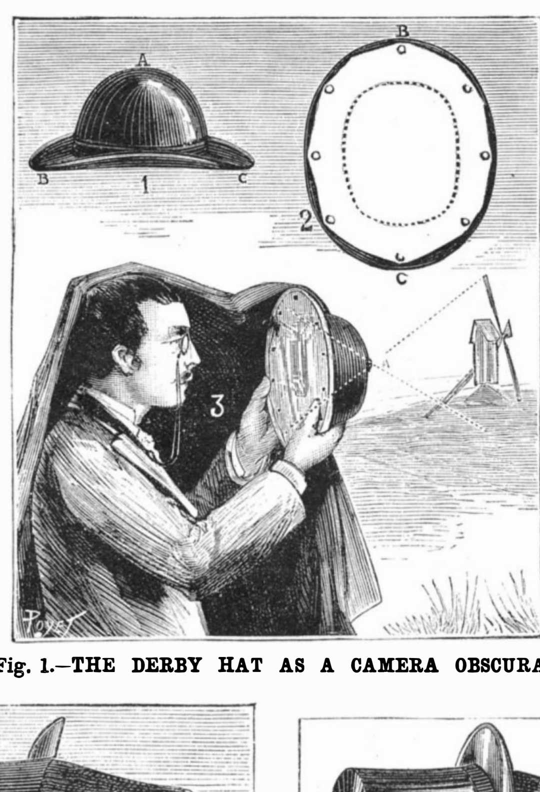


Fig. 1.—THE DERBY HAT AS A CAMERA OBSCURA.

If the hat is not provided with a ventilator, an aperture may be made in the crown by means of a red hot nail, or a punch, if you have one. This aperture should not be more than a tenth of an inch in diameter, and its edges must be very sharp. As a finishing touch, a blackened copper eyelet might be set into it.

Amateurs dream of light apparatus—that joy of the traveling photographer. Here is one represented in the accompanying engravings. A beaver hat, provided with a lens holder, is affixed to the tourist's cane. A special lining does duty for the black veil, and the device is operated by means of an ordinary shutter that is carried in the pocket (Fig. 2, No. 1). The tourist is supposed to have with him a portfolio containing some Stebbing's pellicular *cliches*, small frames of stiff cardboard, and a small square of prepared cloth mounted in a frame, serving as a ground glass screen, and to be fixed in the hat only at the moment of operating. The objective is removable, and is replaced at will by a conical button like those that ornament the Indian helmet. The amateur will be obliged to work bareheaded, as shown in Fig. 3.

It will be necessary to substitute a draw curtain for the ordinary draw frame.—*La Nature.*

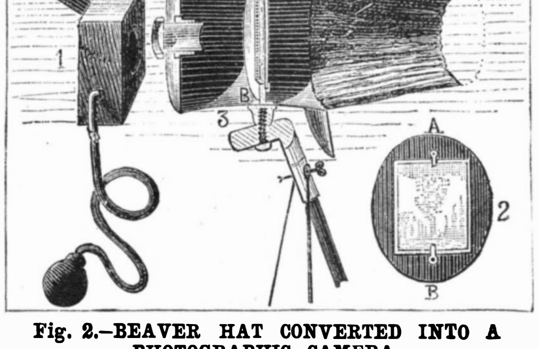


Fig. 2.—BEAVER HAT CONVERTED INTO A PHOTOGRAPHIC CAMERA.

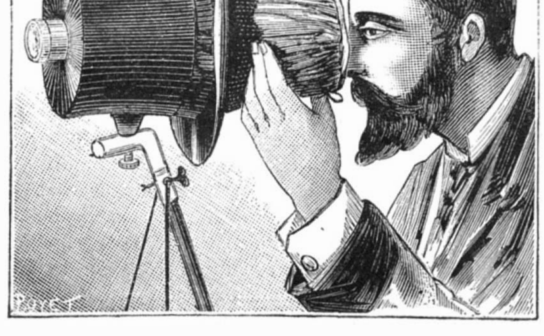


Fig. 3.—MODE OF USING THE APPARATUS.

The New Orleans Exhibition.

Aside from the cotton exhibit, the showing of minerals from various sections of the country, yet undeveloped, is by far the most striking, if not the most important, feature of the Exposition. But even in this part of the display a lack of judgment on the part of the managers is to be seen. Surely a ton of ore from a certain locality is amply sufficient to denote the quality of its deposits; it seems but a waste of valuable space to permit the exhibit of 20, 30, or 50 tons, as is the case in some instances.

It might have been explained to the enthusiastic Arizonians, for instance, that a half ton of ore, or a ton at the most, was amply sufficient to illustrate the richness of Iron Mountain. It was scarcely necessary that they should bring the mountain along with them; and those enterprising gentlemen from New Mexico who discovered the petrified forest should have been induced to leave a larger part of it at home in the ground, that a few longitudinal and cross sections would have sufficed to show how fine a polish this really curious fibrous stone is capable of receiving.

The exhibits from the Southern coal and iron fields, when considered along with the statistics of the recent output, does much to show that at no distant day the South may be looked to to supply its own fuel and iron ware. The Alabama iron people say they have inexhaustible beds of the best iron ore, with coal and limestone close at hand, and that ere long they will be making iron for from $9 to $10, against the $16 and $17 which it costs to make it in Pennsylvania. Indeed, if the limitless coal and iron fields in the South and West, represented at New Orleans by specimens, should ever be simultaneously worked, the time may yet come which was prophesied long since by an enthusiastic Yankee, when Newcastle will furnish a good market for American coal, and in Sheffield be found a ready sale for American steel.

The product of the California vineyards, a part of the agricultural department, attracts, as might be expected, not a little attention from foreigners, and may even be said to be more or less of a revelation to natives. New Orleans, probably more than any other city in the country, is a wine drinking city, by reason of its large French, or rather Creole, population. Like the inhabitants of the *Quartier Francais* in New York, the Creoles would not knowingly drink any wine of American growth, in the belief that it is rough and acidulous, and contains too many headaches to the quart. But in tasting this California wine at the Exposition, the Creole palate could scarcely have failed to recognize an old and much valued friend, for, as is well known, the major part of the California wine crop—last year it was fifteen million gallons—goes into bottles labeled Bordeaux, Rheims, etc. Part of this, an immense quantity, crosses the ocean, and after a short sojourn in a French laboratory, where it is fortified, loaded, and otherwise adulterated, comes back as French wine, and commands an enhanced price as such. But the Zinfaudel and Riesling wine of Sonoma needs no French label to give it a value, and though by no means up to the standard of the choice French vintages, is said by good authorities to have more body than the average of French wines, and a *gout* not at all inferior.

These California wines, as exhibited, are said to show unusual improvement over the product of former years. The viticulturists of the State observe more care than formerly in selecting the proper soil and exposure for the different descriptions of grape. The necessity for cultivation, too, is becoming more and more recognized, and the result is that the vines are more mature. The fact that the demand for California wines is greater than the supply does much, it is said, to encourage the grower to look after the quantity of his product rather than its quality. There is an inclination, as the statistics show, to give a large quantity of grapes of the rougher and less prized descriptions, because requiring little cultivation, and only a small quantity of the finer qualities, which require much care and labor—just enough to induce the middleman or dealer to take the whole cellar on a general average.

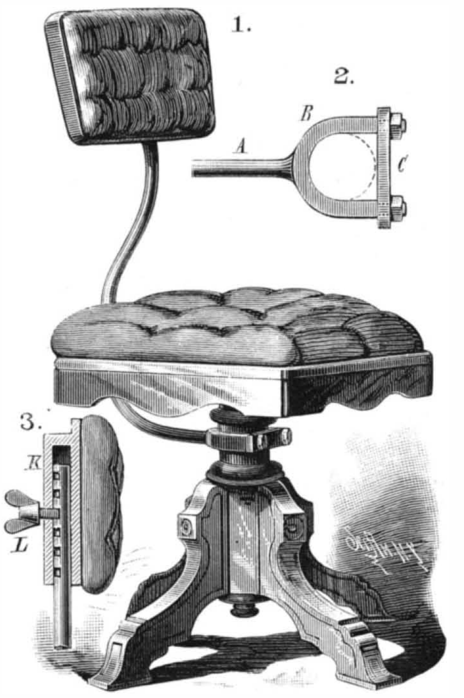
At the World's Fair, as at the recent exposition in Philadelphia, there is a dearth of instruments of precision and a plethora of money-making applications of well known laws among the domestic exhibits. There are, however, some notable exceptions to this at New Orleans. A carefully contrived pendulum for measuring high altitudes is shown by a Washington manufacturer, among many other mathematical apparatus. It was devised by a young engineer named Loring, or rather it is an improvement on an alleged improvement upon a similar instrument, which repeated trials some time since proved to be not at all times to be relied upon.

A New York surgical instrument house shows an electrical apparatus for lighting up certain parts of the human body. It is somewhat similar to those already experimented with, but is said to be far more efficient, and to give much better results. It consists of a curved tube containing a fine wire of silicious bronze to conduct the current to the incandescence lamp on the end, and which permits the constant flow of a column of water around the lighting bulb to prevent the generation of heat.

There is also shown an ingeniously contrived instrument, which is said to be invaluable in certain delicate obstetrical operations, and is the handiwork of Dr. Blake White, of the New York Board of Health. New York, it may be said, though making a poor show as a State, is represented in the manufacturing exhibits of nearly every other State.

BACK FOR PIANO STOOLS.

The back rest shown in the engraving, recently patented by Jeannette D. Baldwin, of Moore's Hill, Indiana, can be secured to piano stools of all kinds without interfering with the turning and revolving of

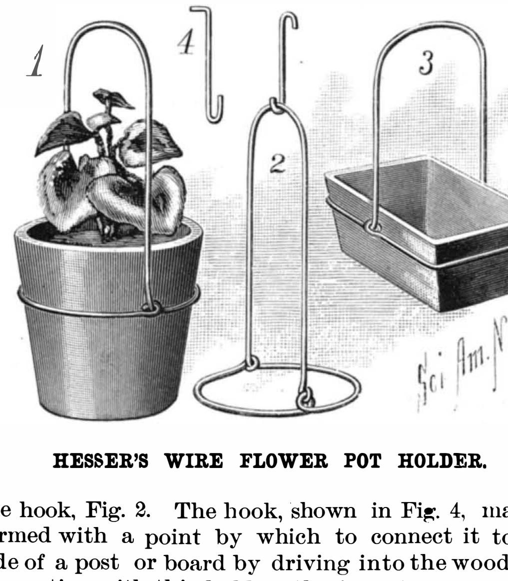


BALDWIN'S BACK FOR PIANO STOOLS.

the stool. A curved bar, A, is provided at its lower end with a fork, B, to receive the upper end of the stool. The ends of the prongs of the fork are screw-threaded to receive nuts which hold the cross plate, C, the latter being by this means drawn up tightly to clamp the fork on the stem. The bar, A, curves as shown in Fig. 1; its upper part being made straight and rectangular, and provided in the back with a series of notches. The notched section passes into a pocket on the back of a frame, K, whose front is upholstered to form the back rest proper. The back may be held at any height, the binding screw, L, entering one of the notches. The rod does not interfere with the revolving of the seat, and the entire back rest can easily be removed from or secured on the stool. The device is equally applicable to any revolving chair.

WIRE FLOWER POT HOLDER.

An invention lately patented by Mr. William J. Hesser, of Plattsmouth, Nebraska, consists of a holder for suspending pots containing plants and flowers. A piece of wire of suitable size and length is bent to the form plainly shown in Fig. 2. The flower pot, of whatever shape, is placed in the lower or ring portion of this frame, which may be suspended by means of



HESSER'S WIRE FLOWER POT HOLDER.

the hook, Fig. 2. The hook, shown in Fig. 4, may be formed with a point by which to connect it to the side of a post or board by driving into the wood. In connection with this holder, the inventor purposes to employ skeleton wire stands with cross bars and brackets, from which to suspend the holders, thus making a simple, useful, and ornamental contrivance that will afford the most room for the pots and will give the least obstruction to the light. The device is simple and efficient, and since but a single piece of wire is used, it is more rigid and better than if the bail were hooked into eyes made in the ring portion.

A New Time Check System.

The problem of insuring punctuality of the workmen in large establishments has long been troublesome.

Latterly electrical and automatic devices have been used with more or less success. The *Commercial Bulletin* describes one of these, whose origin is due to Rhode Island, that regulates the time for the entire establishment by an electric regulator in the mill office. At the hours of starting or stopping work, gongs ring simultaneously in all the departments, and the machinery is started. One large machine shop where the system is in successful operation employs five hundred hands, who are distributed among twenty-four departments, each of which has an appropriate letter, each man being known by a particular number. Every night each hand is given four circular brass checks stamped with the letter of his department and his own number. Two of these are small and thick and two large and thin, the first to be deposited by each man as he leaves the workshop, the latter when he enters it.

In the basement of every building there is an electric dial connected with a series of metal boxes stamped with the hours of the day, and so connected with the dial that as the hands of the latter revolve fifteen minutes, the circle of boxes revolves one place. Above these boxes project a pair of tubes running to every floor, with openings at each floor for the reception of checks. When a man enters the room at the top of the building at one minute of one, and drops his check stamped with his letter and number, it falls into the box stamped one o'clock; if the check is dropped at one minute after the hour, the hands of the dial and the system of boxes have revolved, and he is taxed with a quarter hour's lateness. The checks are collected at the end of the day, and arranged on tabulated boards, so that at a glance the time of the man at his post can be ascertained.

The number of checks given out provides for a man's entrance and exit at morning, noon, and night, with an extra pair of checks in case he should be called out and return during the day.

In every room there are two openings in the tubes, one labeled OUT, the other IN. Every time a man leaves the workshop, he must deposit a small thick check in the first tube, and every time he enters it a large thin one in the second, the checks falling and registering themselves in the manner described above. Owing to the difference in the shape of the checks and their respective openings, the confusion caused by a man's slipping an inward check into the outward receptacle is entirely avoided.

A difficulty which was at once experienced when the system was introduced was the advantage which might be taken by the workmen on the upper floors. A man might enter the lower floor, promptly deposit his check in the receptacle on that floor, and, unless noticed by some passing foreman, loaf and chat for ten or fifteen minutes about the stairs and passage ways, his check registering him as having arrived and reported promptly for work. This objection has been avoided by preparing the checks with a little boss or circular projection in the center, the openings in the tubes being made to correspond. This boss is large in the checks to be deposited on the upper floor, and small in those used on the lower. Consequently, a man cannot deposit his telltale check anywhere but in the proper receptacle in his own room under the eye of his foreman. In spite of the complexity of the new system, the results have been satisfactory.

A Decimal System of Time.

The following is an extract from a paper read before the Canadian Institute, Toronto, Canada, by Prof. W. J. Loudon. The system proposed is based on the decimal system.

The present day of 24 hours would be divided into ten divisions, so that each hour, if we might so call it, on the new system would correspond to 2 hours 24 minutes. This hour would be again divided into 100 divisions, called minutes if necessary, each minute on the new system thus corresponding to 1·44 minutes, a good fractional unit. Again, this new minute division could be subdivided for accurate measurements into 100 divisions, called seconds. The advantages arising from such a system would be:

1. The abolition of the so-called A.M. and P.M. nuisance—what has already been accomplished by the 24 hour system.

2. All the advantages to be derived from the adoption of any system based on our scale of 10—namely, the inconveniences arising from the continual use of vulgar fractions and the use of symbols for each unit in the ordinary affairs of life.

3. The fact that the time in hours and minutes (which for all practical purposes is sufficient) is indicated immediately by the clock. This is the most important advantage, because in the present system we have always to multiply by five before we know the time—thus 1 means five minutes past, 2 means ten, 11 means fifty-five past, or five to, and so on; and this would really overcome the great difficulty experienced by most children in learning to tell the time.

THE NEW ORLEANS EXHIBITION.

(*Continued from first page*).

arisen in waterworks, as in these cases friction was of small comparative moment, since the lengths of pipe to be pumped through were almost invariably short. When the first lines of oil pipe were laid, attempts were made and oil was pumped through by use of the donkey pump. As generally constructed, this was a single cylinder pump having a very long cylinder of small diameter—gun barrel pumps, as they were sometimes called. When these machines were at work, the whole volume of oil they were forcing forward came to a dead rest at each end of the stroke; and to show the severe strain the pipe and engine were subjected to, it may be mentioned that it was not an uncommon sight to see the index on the gauge dancing between the 500 mark and the 1,000 each time the stroke was reversed. This instant increase of 500 pounds pressure resulted in frequent broken pumps and bursted pipes.

When the duty required had outgrown the capabilities of the single pump, Mr. Henry R. Worthington adapted the duplex system to this particular case. In this system the column of liquid is kept in continuous motion, one piston beginning work where the other leaves off; and so advantageous has this method proved, that it is universally adopted in almost all sizes and for almost all purposes. The difference in the two is well illustrated by the hopping upon one foot, and the walking, of a man. In the first case his body is carried forward by a series of jerks, in the other the forward movement is steady and with a marked saving in the power expended. So well has this plan worked that we now have on the oil pipe lines many sets of pump, which are on duty continuously 24 hours in the day and 365 days in the year, pumping oil against a continuous pressure of from 800 to 1,200 pounds per square inch, and in some cases this pressure will run for a short period up to 1,500 and 1,600 pounds to the inch, according to the piston speed of the pumping engine. Accidents are rare, since the pumps are built to resist the pressure, and the pipes have a large amount of surplus strength. The oil fields supplied the demand, and in satisfying that demand we have obtained the experience and skill enabling us to handle liquids under great pressure.

The Worthington pumps, while occupying a most prominent position in this particular field, have been applied to all industries requiring engines of either large or small capacity, or of peculiar construction. In connection with waterworks, they have been extensively adopted, there now being in use, for this purpose alone, more than 250 pumps, having an aggregate capacity of 900,000,000 gallons every twenty-four hours, or enough to supply with 30 gallons per head each day a population of 30,000,000 people.

In the frontispiece we give a view of the exhibit made by Henry R. Worthington, of 86 and 88 Liberty Street, New York city, at the New Orleans Exposition; a view of the stand pipe from which the Exposition grounds are supplied with water; and also a view of the waterworks engines at the Ninety-seventh Street station, this city.

The aim of the exhibit is to show the various styles of pumps and their operation, but so large has the business grown, that the space secured by the firm is not sufficient to contain a representative of each class of machine made by them, and we therefore find that many of the special patterns are absent. Although the business of the firm is chiefly confined to compound, condensing or non-condensing engines for waterworks, feed, mining, and fire pumps, pumps for oil pipe lines, air pumps, etc., they also manufacture hydraulic cranes and hoisting machinery, valves, fittings, water meters, etc.

In the Worthington high pressure pump of ordinary construction a common slide valve is used, working upon a flat face over the ports. Owing to the simplicity and reliability of this form of valve, it is used in all these engines. The valve is operated by a vibrating arm swinging through the whole length of the stroke with long and easy leverage, and as the moving parts are always in contact, the blow occurring in the tappet system is avoided. The plunger is double acting, and works through a deep metallic packing ring, centrally placed so as to divide the water end into two chambers, and bored to an accurate fit, being neither elastic nor adjustable; both the plunger and ring can be quickly removed when necessary. The plunger is placed some distance above the suction valves, thereby forming a settling chamber in which any foreign substance may fall below the wearing surfaces; this greatly increases the durability of the pump, especially when using water containing grit or other solid material. The waterway from the suction chamber to the delivery chamber is very direct and ample. The valves consist of small disks of rubber or other suitable substance.

The two steam pumps are placed side by side and combined, so as to act reciprocally upon the steam valves of each other. One piston acts to give steam to the other, after which it finishes its stroke, and waits for its valve to be acted upon before renewing its motion; this pause allows all the water valves to seat quietly and remove all jar. There is no dead point in the stroke, since one of the steam valves must always be open.

In pumps requiring the delivery of fluids against very heavy pressures, the steam cylinders are like those in the waterworks engines, but, in place of the interior double acting plungers, those with exterior packings are substituted, working into each end of a cylinder divided by a partition. They are connected together by yokes and exterior rods, in such manner as to cause them to move together as one plunger, so that while one is drawing, the other is forcing the fluid, thus making the pump double-acting. The valve boxes are also modified, for the purpose of subdividing them into separate small chambers capable of resisting very heavy strains. The valves are metallic, sometimes leather faced, with low lifts and small surfaces. The general characteristic of independent plungers with outside packing, is in all cases preserved, although alterations may be made to adapt the pump to different requirements. The severe work to which these pumps are often applied, not less in some cases than 4,000 pounds to the square inch, demands the most thorough construction, and the use of the very best material. On the oil pipe lines, a number of these engines, varying from 200 to 500 horse power each, are in constant use, some of them being required to deliver from 15,000 to 25,000 barrels of oil per day against pressures varying from 1,000 to 1,500 pounds per square inch.

The Pipe Line Across the Egyptian Desert.

At the present time the attempt of the British Government to build a water pipe line across the Egyptian desert from Suakim, on the Red Sea, to Berber, on the Nile, is attracting much attention for many reasons. That the line can be built and successfully operated, we have no doubt; that to quickly accomplish these results will require men of skill and experience in this particular branch of engineering, and the use of material—pumps and pipe—which will without question perform the duty required of it, are parts of the problem dependent one upon the other. With either of these factors missing, the task becomes a gigantic experiment, which, while it will prove an admirable school in which to become acquainted with the difficulties attending the forcing of liquids through great lengths of pipe, will not be of much assistance to the government in furthering its projects, and may result in the loss of many lives.

Simultaneously with the pipe line, a railroad will be built; without the one it would be almost impossible to construct the other.

During the months of March and April, 1875, the Suakim-Berber route was passed over by Col. H. G. Prout, then of the general staff of the Egyptian army; and from a recent article of his, giving a plan and profile of the route, published in *Engineering News*, we obtain a good idea of the topography of the country. As the present operations are being prosecuted during the same time of year, we may regard the water supply at various points to be the same now as then. From Suakim the land rises until, at a distance of sixty miles it reaches the greatest elevation, a little more than 3,000 feet; from this point the slope is gradual to the Nile, which, at Berber, is about 1,100 feet higher than the Red Sea. Suakim is supplied with water from wells about two miles inland; from this point forward the following supplies are met: At nine and fifteen miles are wells sufficient for five hundred men with their camels and horses; at twenty miles are water holes, three feet deep, which fill slowly, and could not supply half the above number of men. At about thirty miles from Suakim the first difficulty in building a railroad is encountered, as the pass is narrow and crooked for some miles, and the grades steep. At sixty-two and seventy-five miles from Suakim are wells that are curbed with timber, and furnish a large supply of water. At eighty-seven miles is a steep, winding pass —the last point on the line where any difficulty would be found in locating a railroad.

For about 30 miles the route is through barren plains and granite hills, the only water being from two or three small wells; 21 miles east of Ariab, which is described as a genuine oasis containing many beautiful trees and good browsing for camels and goats, is a large well of good water; for 54 miles from Ariab there is no water. At this place, O-Baek, the wells are constantly filling and being dug anew, the water gradually turning brackish and becoming unfit for use; from here to the Nile, 68 miles, is a stony plain without water, tree, or herb. The distance from Suakim to Berber over this route is about 275 miles. The impracticability of passing large bodies of troops through this country will be readily understood from the brief sketch given above.

The present plan is to run two four-inch pipes over this route, and at every 20 or 30 miles locate a tank and two engines, one acting as a reserve. The pipe is to be lap-welded wrought iron, one-quarter inch thick, connected by an external threaded sleeve five inches long and one-half inch thick; each sleeve is tested to 1,800 pounds pressure. The pumping engines are of the duplex style, the steam cylinders being 18 inches in diameter, the stroke 18 inches, and the pump plungers 5 inches diameter; the suction pipe is 6 inches, and the delivery pipe 4 inches. The working steam pressure will be about 80 pounds, steam being supplied by portable boilers; the pressure in the mains will vary from 500 to 1,200 pounds per square inch. It is expected that water will be delivered at the end of the route at the rate of 150 gallons per minute.

The contract for the pumps has been let to the firm of Henry R. Worthington of this city, much to the evident displeasure of many of our highly esteemed English contemporaries, who freely censure the government, the contractors, and all others in any way connected with the undertaking for sending out of the country to get machinery. They call attention to the dull times, state that the money should have been kept at home, and say that if the contract had been properly placed the funds would have been removed from one of John Bull's pockets only to find a resting place in another. They claim to be able to build pumps fulfilling all the essential conditions. In all that has been written we have not found a doubt regarding ability of the American pumps to perfectly perform the work required of them, and it is here that we think we must look for the inside facts causing this little difficulty, even though the above statements be both logical and philanthropic, and we may also add charitable, since that virtue is said to begin at home, beyond the precincts of which it is often afraid to wander.

Articles of American manufacture have before entered Europe, and we believe that when once they had obtained a footing they generally managed to stay. This contract will bring American pumps into direct competition with English, and we should not wonder if this item had created most of the dissatisfaction.

Engineering, in commenting upon this subject, strikes the nail squarely when it says that the contractors would "have failed in the first element of prudence had they not gone to those makers who have had the greatest experience in this special class of machinery."

In another article in this issue, upon the Worthington pumps, we briefly show the work we have accomplished in the oil regions with pipe line pumps, many of which are now working continuously under pressures greater than any that would be encountered in the desert.

During the construction of the first part of the line, water will be supplied by mammoth condensers, placed on board ship and using water from the Red Sea. If the supply from the wells at Ariab prove sufficient, water will be pumped from there, both ways. Upon the completion of the line water will be taken from the Nile and forced to Suakim.

The Oldest Locomotive Engineer.

Julius D. Petsch, the oldest locomotive engineer in the country, died last month in Charleston, S. C., the city of his birth. He ran the first locomotive ever built in this country and the second ever in use on an American railway. This locomotive was built at the West Point Foundry works in New York in 1830, and was called "The Best Friend of Charleston," having been built for use on the South Carolina Railway, then in process of construction. It arrived in Charleston on October 23, 1830, and was placed on the road on November 2, 1830. The second engine constructed in this country was built by the West Point works for the same road, which was begun in 1830, and was opened for traffic in 1833, for its whole length, 135 miles. At that time it was the longest continuous line of railway in the world.

Mr. Petsch, as already stated, was the engineer of "The Best Friend of Charleston." He succeeded in inventing a number of improvements to it, which, had they been patented, would have probably yielded him a handsome fortune. The most important of these improvements was the shrinking of wrought iron tires on iron wheels and the placing of what are known as "the outside connections" on a locomotive. After serving as engineer for some time, he was promoted to the office of superintendent of the South Carolina Railway during the presidency of Mr. H. W. Connor.

During the Seminole war Mr. Petsch was employed as an engineer in Florida. As a master machinist, Mr. Petsch was known all over the State. He superintended the building of the "New Bridge" over the Ashley River, the placing of the machinery in the Confederate gunboat Chicora during the late war, and the erection of the machinery in the cotton mill at Graniteville, S. C. He was in his seventy-eighth year at the time of his death.

The 110-Ton Gun.

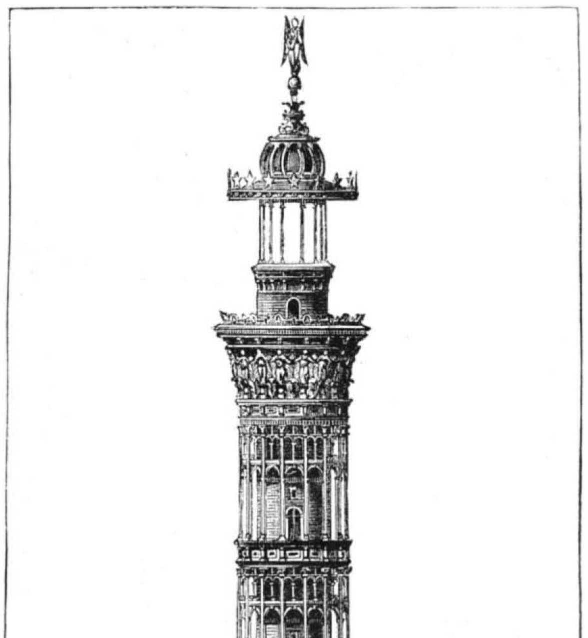
The English government has ordered three 110-ton guns, and of these one is to be delivered in October next, another in January, and the third in April, 1886. The price per gun is £19,500; the projectile is 1,800 lb.; the charge is 900 lb. of cocoa powder; the muzzle velocity is 2,020 feet per second; the maximum powder pressure is 17 tons per square inch. The velocity and pressure are, of course, only estimated, although they are based on the experience gained with the Italian guns.

THE "SUN" COLUMN, DESIGNED FOR LIGHTING ENTIRE PARIS.

Mr. J. Bourdais has just presented to the Society of Civil Engineers a project that he has been studying, and that concerns the erection of a masonry tower 300 meters (984 feet) in height.

After an examination of the different geometric profiles realizable, Mr. Bourdais has adopted the column as being more apt than any other form to satisfy the rules of æsthetics, and also as being the most stable. In fact, the highest chimney in the world, that of Saint Rollox near Glasgow, 433 feet in height, has been submitted to numerous storms without suffering therefrom, and, as other chimneys exposed to great wind pressure have never given rise to any accident, it results that a cylindrical form is the one that should be adopted.

In short, Mr. Bourdais' structure would consist of a base 216 feet in height, in which would be established a



PROPOSED ARTIFICIAL SUN FOR PARIS.

permanent museum of electricity. Above this would rise a six story column surmounted by a roof forming a promenade and capable of accommodating 2.000 persons. The central granite core, 60 feet in diameter, would be surrounded with an ornamental framework of iron faced with copper. Ths would be divided into six stories, each containing 16 rooms, 16 feet in height and 50 feet square, designed for aerotherapic treatments. Patients could come here to find a purity of air that is usually met with only on mountains.

The central core would be hollow, so as to permit of all sorts of scientific experiments being tried. Finally, at the summit would be placed an enormous electric lamp, studied by Messrs. Bourdais and Sebillot, that would cast a flood of light over the entire city. This lamp would have an intensity equal to that of two million Carcel burners. The lamp would be surmounted by a statue representing the genius of science. This would make the entire structure 1,180 feet high. We are indebted to *Le Genie Civil* for the accompanying illustration.

A CHEAP BATTERY.

It frequently happens that people living in the country, and far removed from our electrical supply stores, are desirous of having in their possession for experimental or practical use an electric battery, and are discouraged from attempting to secure one by ignorance of proper parties to apply to or the difficulty of transportation. To such as these, and to those who are of an inventive turn of mind, or are fond of "tinkering," perhaps a few hints as to how to make a battery will not be amiss. The cheapness of the form of battery described is also one of its chief virtues, for the cost of the materials required is almost nothing, and the time required for putting together the different parts very little.

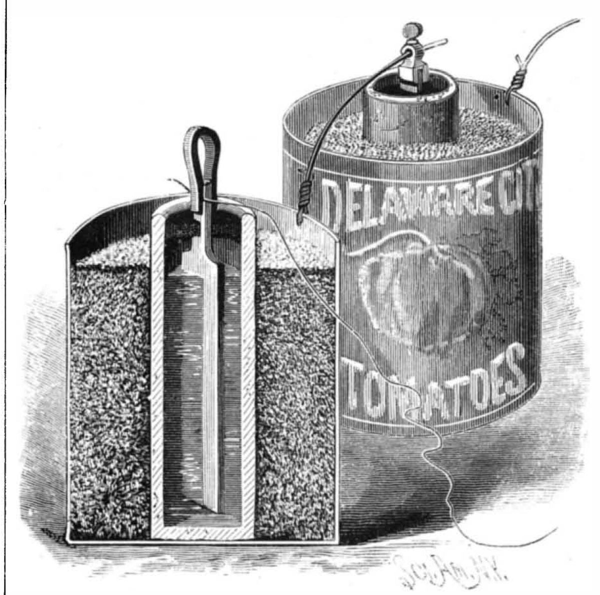
The first step is to secure a strong tin can. The proper article can be purchased at any hardware store, or even this is not necessary, for an ordinary large sized vegetable tin will do. The former is the better, as the joints are better clamped, and less solder is required. If much solder is used in the joints, it will be necessary to coat it with melted pitch while the tin is warm, as the chemical is apt to eat away the solder. Of course the tin cans are used as the outer cells of the battery, and should therefore be as nearly of a size as possible. It is important to secure cans that are well tinned and free from rust and pin holes. The next most important thing is the inner cell. This consists of an ordinary earthenware pot, made commonly of red clay, like a flower pot, and as such cells are made of all sizes by potters, there is little difficulty in obtaining them. These pots are highly porous, as is well known, but before they are suitable for service as cells it is necessary that they should be rendered non-porous in the upper part for about one-third of their height, for a reason that will be seen later. This is accomplished by dipping the pot at different intervals into a bowl containing melted paraffin wax. The wax fills into the rough surface of the clay, and very soon renders it impervious. The space between the two cells is to be filled with iron borings, which may be secured from the lathe of a metal turner, or, if this is not at hand, iron scraps would serve, such as iron wire, old nails, etc., or even old pieces of tin ware thoroughly cut up. Care should be taken, however, that no pieces of copper or brass ware or galvanized wire are mixed in with the borings.

The inner cell is to be filled with the chemical, which should be caustic potash in solution or caustic soda. The former is preferable. The active properties of these alkalies are well known, and they should be kept as far as possible in crockery or glazed vessels, as they will devour cork, tin, zinc, and animal tissue. Every precaution must be taken to prevent the liquid from coming in contact with the skin, as it eats the flesh and causes grievous wounds. This destructive feature of the alkali is the very quality, however, which is active in the production of the electric current. As has been said, zinc is voraciously attacked by the chemical, and it is therefore this element which is employed in this battery for the purpose of generation. A thick plate of zinc should be procured; roofing zinc will do, or if this is not to be procured, rods of zinc, not too thin, however, as the metal soon begins to dissolve in the solution, absorbing the oxygen from the alkali and liberating hydrogen, thus forming an oxide of zinc.

A thin tang of the plate should be formed to extend up through the covering of the cell, which latter is next to be considered. The object of the covering is to prevent the carbonic acid of the air from reaching the solution and to keep the caustic salt from creeping out. This covering is an important feature, and is made very simply out of a cork or wooden stopper, turned to the proper size to fit the earthen cell, and with a hole in the center for the admission of the tang of the zinc plate. The bung must be thoroughly soaked in paraffine or pitch, and must be sealed with the zinc element in the cell after it has been filled with the caustic alkali. Care should be taken, in filling the battery with this solution, to have the liquid rise considerably above the line of paraffine on the walls of the cell. To render the cell more completely air tight, a rubber band is sometimes used in connection with the wooden bung, this being covered over with the paraffine or pitch after the bung is inserted.

Now, all is ready for connecting the batteries. The cell has already been placed inside the tin can and the borings packed around it, and it is only necessary to join a copper wire to the tang of the zinc or connect it by a simple spring clip, as shown in the engraving, and connect it with the tin of the next battery, the outer cell of each being connected with the inner cell of the next battery.

Owing to the porosity of the clay cell, the borings will very soon become moistened with the alkali; and as neither the iron nor the tin will rust, owing to the

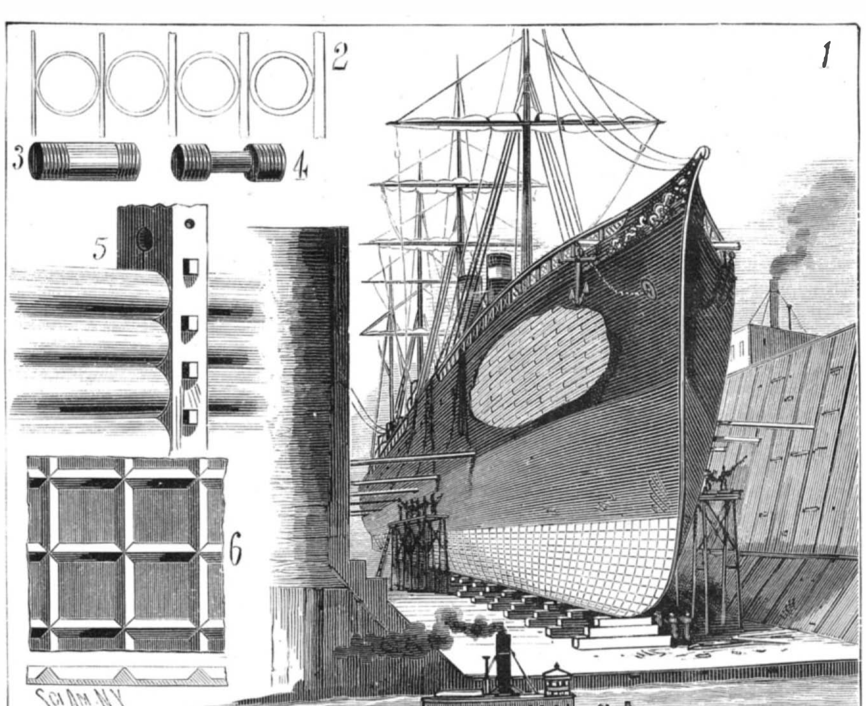


A CHEAP BATTERY.

presence of the alkali, this part of the battery will last for a long time. The zinc will be the first to show signs of decay, and this may need an early renewal, according to amount of work required to be done by the battery. This amount of work also determines the number of batteries that may be required. This battery was invented by Mr. Bennett, of England, and he estimates the cost of its construction at 6d., which estimate, doubling the expense of everything in this country, would bring the cost of each battery to less than 25 cents apiece. These batteries may be found of service in running experimental electric lights and small electric engines.

IMPROVED CONSTRUCTION OF VESSELS.

The object of the invention herewith illustrated is to construct the hull of a vessel of a stronger and more buoyant form than heretofore made, with the same amount of material. The hull is built up of a series of steel tubes, placed side by side and extending transversely the thickness of the vessel, with skins interposed between the tubes and secured to the outer and inner tubes, as shown in Fig. 2. While the tubes remain of the same diameter, the thickness of the steel increases toward the interior of the vessel, thus making the hull thicker and stronger on the inside; the intervening skins or plates also vary in thickness. The lengths of the tube section are comparatively small, and they are joined together at measured in-



ESHELMAN'S IMPROVED METHOD OF CONSTRUCTING VESSELS.

tervals by plugs, each length thus forming a watertight compartment. The plugs may be solid or hollow; Figs. 3 and 4 show two forms. The cylindrical ones are employed to join two tubes where no ribs are used between them, while those formed with cylindrical heads are used to join the superimposed tubes at their junction with a rib, Fig. 5, the plugs passing through holes in the ribs. The tubes and rib are flush with each other, and skins or plates are secured to the outer and inner faces of the tubes and ribs. The keel, keelson, and false keel, before being laid, are made hollow and plugged at certain intervals, and the stern post is similarly constructed to insure greater buoyancy. The knees, beams, and curlings are hollow tubes plugged at points. The decks and transoms for the hatchways are built of tubes in the same manner as the sides of the vessel, and are provided with wooden coverings. The steel skins and tubes connecting with the keel, commencing with the garboard streak, are made much heavier proportionately than the upper sides of the vessel, this serving the main purpose of strengthening and adding to the weight of the vessel near its bottom, so that it will always float keel downward. The vessel may be formed with a water bottom, conforming in shape with the bottom of the hull, and provided with longitudinal and cross ribs (Fig. 6) upon its outer face, thereby forming rectangular water spaces. The cradle strengthens the bottom by forming a covering, and also adds to its weight.

Further particulars can be obtained by addressing the inventor, Mr. John L. Eshelman, care Mr. G. W. Cook, Superintendent D. & R. G. R.R., Leadville, Col.

The Buffalo Gnat.

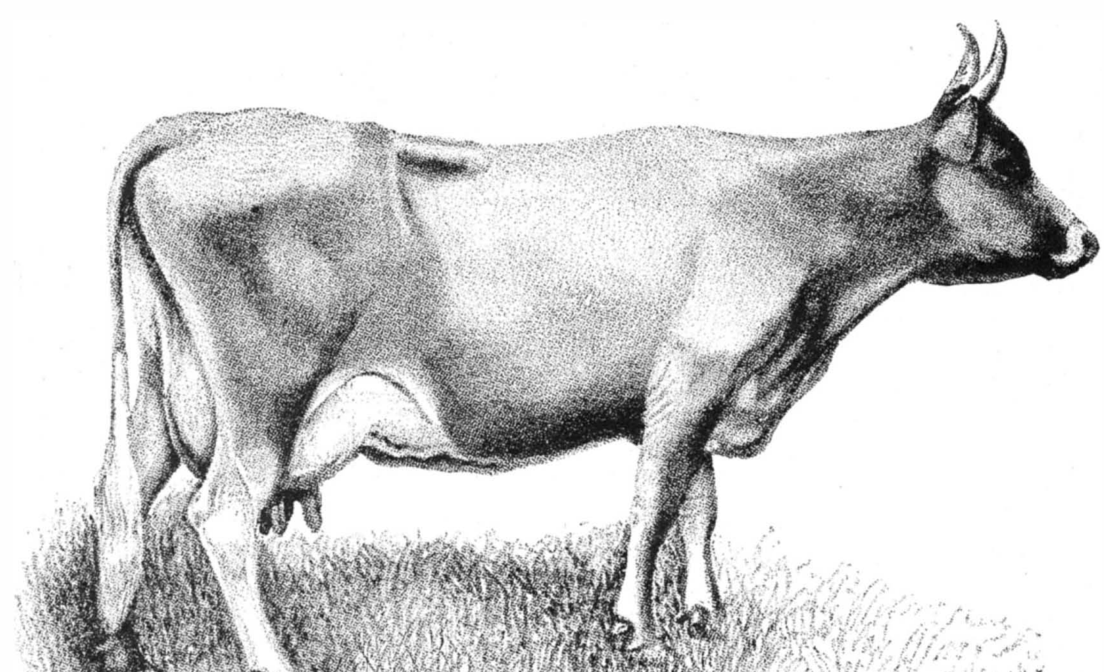
For many years past, says Prof. C. V. Riley in a recent report, one of the greatest pests the stock raiser of the South and West has had to contend with has been the so-called "buffalo gnat." This insect is a small fly, closely related to the well known "black fly" of the Northwestern woods. At certain seasons it swarms in immense numbers, and by its poisonous bite, multiplied a thousand-fold, causes great destruction among sheep, hogs, poultry, cattle, horses, and mules.

JERSEY COW MOLLIE GARFIELD.

As the years go by, the value of pedigree of the dairy cow grows less and less, and in proportion the test at the churn gains in importance. Many once famous and high-priced families of Jerseys are becoming unknown, and the cows, and the families of the cows, that make from fourteen pounds of butter per week and upward, are those that command attention. We show this week, on this page, the Jersey cow Mollie Garfield, 12,172, the property of F. S. Peer, Mt. Morris, New York. While she traces back to John Le Bas 398 and Pilot Boy 3, she performs, at the milk pail and churn, in a way to entitle her to be placed amid the good butter producers.

In 1881, for the month of July, she made an aggregate of eighty-two pounds of butter, and again in 1882, during the month of August, she made eighty-one pounds, being an average of over two pounds ten ounces daily. She is somewhat over eight years old, of a dark fawn color, with a remarkable development of the milk veins, as will be seen by our very accurate cut, made from a photograph.

She has a daughter, Mollie Garfield 2d, 18,662, that made last summer sixteen pounds four ounces of butter per week, and another that made fifteen pounds seven ounces. While, as is well known, we have never catered to the Jersey boom, we believe that a judicious infusion of the Jersey blood into our dairy herds is advisable, now that bulls of this breed can be bought at reasonable prices.—*Rural New-Yorker.*



MOLLIE GARFIELD. (From a Photograph.)

TELEGRAPH wires have to be renewed every five or seven years. The Western Union Telegraph Co. exchange about one thousand tons of old wire for new every year. The new wire costs from seven cents to eight cents per pound, and for the old about one-eighth of a cent a pound is allowed.

Gray Hair.

Many persons begin to show gray hairs while they are yet in their twenties, and some while in their teens. This does not by any means argue a premature decay of the constitution. It is a purely a local phenomenon, and may co-exist with unusual bodily vigor. The celebrated author and traveler George Borrow turned quite gray before he was thirty, but was an extraordinary swimmer and athlete at sixty-five.

Many feeble persons, and others who have suffered extremely both mentally and physically do not blanch a hair until past middle life; while others, without assignable cause, lose their capillary coloring matter rapidly when about forty years of age.

Race has a marked influence. The traveler Dr. Orbigny says that in the many years he spent in South America he never saw a bald Indian, and scarcely ever a gray haired one. The negroes turn more slowly than the whites. Yet we know a negress of pure blood, about thirty-five years old, who is quite gray.

In this country, sex appears to make little difference. Men and women grow gray about the same period of life.

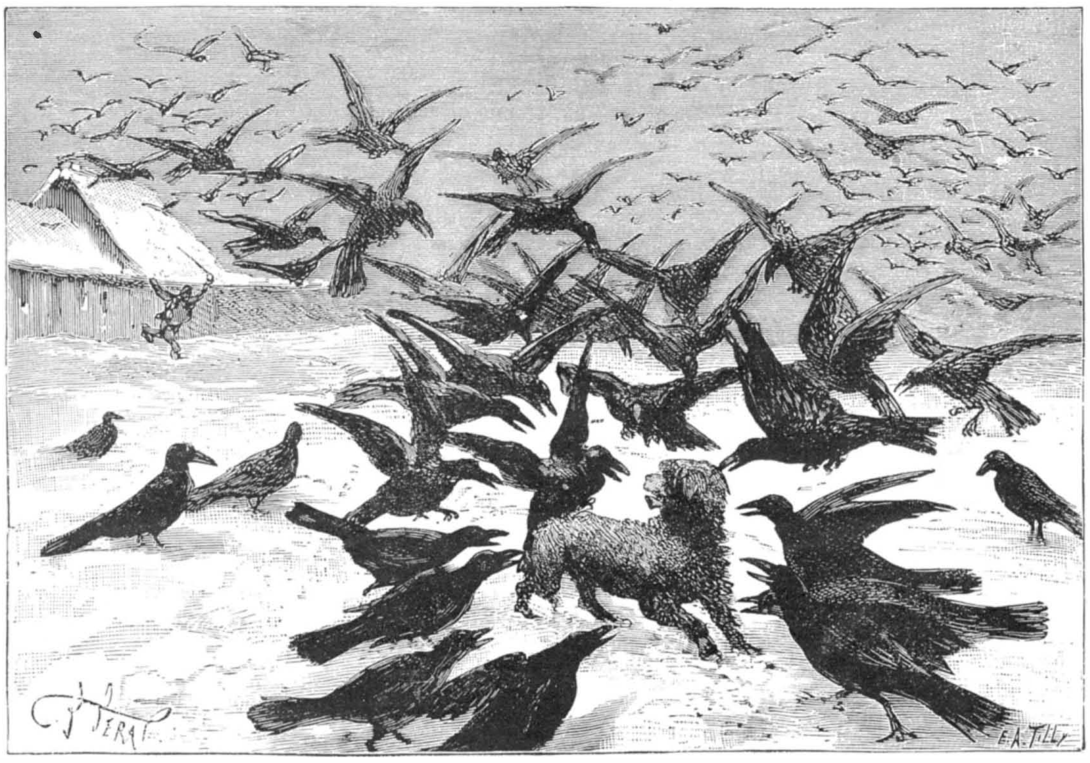
In men the hair and beard rarely change equally. The one is usually darker than the other for several years, but there seems no general rule as to which whitens first.

The spot where grayness begins differs with the individual. The philosopher Schopenhauer began to turn gray on the temples, and complacently framed a theory that this is an indication of vigorous mental activity.

The correlation of gray hair, as well as its causes, deserve more attentive study than they have received. Such a change is undoubtedly indicative of some deep-seated physiological process, but what this is we can only ascertain by a much wider series of observations than have yet been submitted to scientific analysis.—*Med. and Surg. Reporter.*

A FIGHT FOR LIFE.

The *Echo de la Frontiere*, a journal of the Department of the North, recently gave an account of a remarkable occurrence in that part of the country. It was to the effect that some ravens that were starving during the snowy weather of January had pounced upon a dog and devoured him. Wishing to assure ourselves of the truth of the statement, we wrote directly to the superintendent of the Saint Albert glassworks, who, at our request, kindly gave us some accurate data upon the subject. We reproduce a portion of his letter:



A FIGHT FOR LIFE.

My dog, which was a long-haired Scotch terrier, was playing with some other dogs in a field adjoining the works, when he was attacked by some ravens that were doubtless famished. He was about two hundred feet from the building when the workmen saw him surrounded by the birds. There were at least a hundred of the latter in the field, but only about thirty of them had attacked him. These at first surrounded him on every side, but soon divided into two bands. Some flew in front of the dog, others behind him, pushing him forward. Those in front of him rose to a height of about six feet and then swooped down upon him, and always struck him in the same place. The dog, which had at first tried to defend himself, endeavored to escape, but the ravens in front and behind prevented him, and kept continually lacerating him with their bills. They had put out one of his eyes, had made a deep wound in his neck, and would certainly have picked him to pieces upon the spot had not a boy of the establishment been sent to his relief by the workmen.

When the dog was picked up, the ravens, far from flying away, remained near the earth, rather aggressive than timorous. They remained for some time at the spot whence their prey had been taken, while the boy ran to the works with the poor old faithful dog, which had to be killed two days afterward, on account of his wounds.

This account gives a striking example of the terrible fight for life that all living beings are compelled to undertake against each other here below in order to exist. It also shows how much temerity and audacity the cruel necessities of hunger will sometimes inspire an animal with.

It will be seen that the way in which the dog was attacked may be cited in support of the raven's intelligence. These bands of assailants, separated into two camps of observation, in the midst of which some individual assaulted the victim, certainly obeyed an organized plan of attack.

Count Wodzicki, in his book named "The Alps," has, as a conscientious observer, described the habits of ravens, and he tell us that he has several times seen these birds devouring a hare that they had pursued, after charming it with their croakings and forcing it to hide in the ground.

As well known, ravens, which among birds play the same part that the fox does among mammals, sometimes eat barnyard fowls; but it had never been heard that they were capable of giving battle to a dog, even of quite small size. The fact has appeared to us of interest to put upon record. It shows that during winter, when the ground is covered with snow, these birds may prove dangerous. These audacious plunderers might perhaps, under other circumstances, attack a wounded child, just as they did the dog of the Aniche glassworks.—*La Nature.*

THE appearance of platinum may be given to copper by immersion in a bath composed of 1¾ pints hydrochloric acid, 7½ oz. arsenic acid, and 1¼ oz. acetate of copper. The article must be cleaned before immersion, and left in the bath till it has the color of platinum.

Correspondence.

Fixing Pencil Marks.

To the Editor of the Scientific American:

In your issue of February 7, 1885, page 9, question 86, J. B. P. writes to know what will fasten pencil markings, thereby preventing rubbing or blurring. You gave him a remedy; please allow me to give him another and (I think) more simple.

Immerse paper containing the markings to be preserved in a bath of clear water, then flow or immerse in milk a moment; hang up to dry. Having often had recourse to this method, in preserving pencil and crayon drawings, I will warrant it a sure *cure.*

J. C. PELTIER.

Fort Wayne, Ind.

An Intermittent Air Well.

To the Editor of the Scientific American:

About four miles north from town, on the prairie, lives a farmer who, a few years ago, dug a well near his house, 110 feet deep, and curbed it up with plank. Last winter the family was alarmed at a terrible roaring, which was discovered to proceed from the well, and they were fearful that it might be premonitory of an earthquake. The roaring and puffing from the well continued for several days; then quieted down, followed again by the same phenomena. This alternate action and reaction has occurred ever since. The blowing generally commences just after the lull of a powerful wind from the south and southeast.

Looking down, one can see the water below bubbling and foaming in great agitation. When the well is closed over, the air presses through the crevices with a force sufficient, if utilized, to propel light machinery. There is no apparent odor to the air, nor is it any way deleterious to the lungs.

J. O. BARRETT.

Brown's Valley, Minn., Feb. 7, 1885.

Novel Mode of Extinguishing a Fire.

To the Editor of the Scientific American:

We had what seemed to us rather a novel mode of extinguishing a fire. On Sunday morning, Feb. 16, the sexton of the Congregational church built a fire in the furnace, and left it to heat up the church. On his return to ring the bell for services, he discovered the audience and furnace room densely filled with smoke; he at once rang the alarm. A crowd soon collected, but, in the absence of any apparatus for extinguishing fire, all hopes were given up of saving the building, as the fire was under the floor between the joists.

Dr. N. G. O. Coad went to his store and procured two or three buckets full of common soda and a bucket full of sulphuric acid; water was then poured on the soda, and the acid emptied in a tub full of water. The windows were then opened, in order to lift the smoke from the room. The material thus prepared was emptied into the register of furnace; the experiment was a success, as the fire was extinguished instantly. The floor was then partly torn up to make sure, when it was found that a large number of the joists were entirely burned through. The church was saved, and the entire business portion of the village, as the wind was blowing a gale; and nothing but frame buildings, mercury down 20° below zero, and a scarcity of water, presented rather a gloomy aspect to the citizens.

B. T.

Pattersonville, Iowa, March 17, 1885.

Lead Gaskets.

To the Editor of the Scientific American:

We would like to know whether any of your readers have observed weakening of their boilers from the use of *lead* gaskets around man-holes or hand-holes.

We have an upright tubular boiler, 3′ × 6′. At the bottom, on opposite sides, are two hand-holes, about 6″ × 9″. For about two years past these have been calked by gaskets made of sheet lead.

Last November we were alarmed by a stream of hot water, shot from a small hole about four inches from the edge of the hand-hole. As we had a good pressure of steam, and were in the midst of our work, we tried to plug the hole with a pine plug, tapering from three-fourths inch to a point. The hammer drove the plug entirely through the sheet, though the hole had been a very minute one.

We then had a patch put round the hand-hole. The metal round the hole was found to be entirely converted into oxide of iron for a distance of four to five inches from the edge of the hole in all directions. This oxidized ring was limited by a sharp line, and immediately outside of this line the iron was perfectly sound.

To-day we find the other hand-hole in precisely the same condition, being surrounded by a ring of oxide extending about five inches from all round the hole and bounded by a sharp line of sound iron, showing that the action begins at the hole and extends slowly outward. We believe it to be caused entirely by the galvanic action of the lead gaskets, and now believe such gaskets to be a source of danger.

VAN BIBBER & CO.

Cincinnati, Feb. 20, 1885.

[Iron is thermo-electrically negative to lead, the hot water completing the battery element. Lead should never be used as boiler gaskets.—ED.]

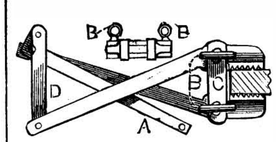
THE RUDDER OF THE ALASKA.

We publish the following additional contributions upon this subject:

To the Editor of the Scientific American:

Having noticed that you invite correspondence on the Alaska rudder problem, I send you my ideas on the subject.

A heavy pair of tongs might have been made, having steel jaws with teeth cut in and hardened—the levers long and heavy; and if there was no suitable screw and nut on board to draw them together, a lever and strap like A and D might have been applied at the end of the levers, and as the lever, A, was brought down to the jaws, it would force them together sufficient to sink the teeth into the iron rudder. As seen in the sketch, the lever, A, has the most power where it is most needed. The device could be made fast to the chain by the eyes, B B, to be lowered and operated. This device would take some time to make, but it could surely have been made and applied sooner than they got assistance from the other ship.



E. R. LANGFORD.

Tombstone, Arizona, March 18.

To the Editor of the Scientific American:

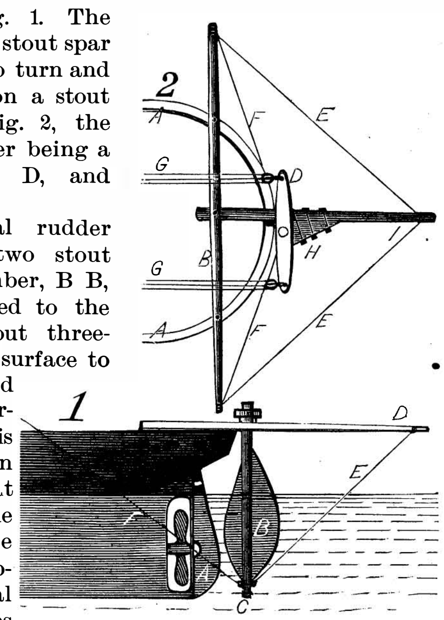
I give you to-day a very simple and, I believe, effective plan for a jury rudder. The materials of which it is composed ought to be within the reach of all steamers that go to the open seas. The only possible objection to it lies in the resting of the apparatus on the chock and on the guys and collar to which they shackle. But, *pro contra*, the whole thing being of wood, and most of it under water, the strain on these parts will not be great, and it is probable that it might be necessary to load the jury rudder or to brace it, so that it could not rise. If the parts, B B, are made of boiler iron, all chances of the rudder's lifting will be nullified.

The following is a detailed description of rudder. The unbroken part of the rudder, A, is to be let alone.

The important part of the new rudder is the spar, C, Fig. 1. The head of this stout spar is supposed to turn and rest freely on a stout chock, H, Fig. 2, the turning power being a heavy yoke, D, and tackles, G.

The actual rudder consists of two stout pieces of timber, B B, strongly bolted to the spar, C, about three-fifths of the surface to be abaft C and two-fifths forward of it; this is similar in shape to what was termed the "equipoise rudder," as applied to several United States ships and to iron yacht Edith. It will readily be seen by those who have had experience of the "equipoise rudder" (which is a misnomer) that very small power will be necessary to work this rudder, provided, always, that the chock, H, be made so as to support C; and while the ship is going ahead the heel of this spar must be so arranged as to give a firm hold to the guys, E and F, and at the same time permit of free revolving, as in a step or pintle.

A A, round of stern at rail; B, spar for guys to hold C; C, spar to hold new rudder; D, yoke to which steering tackles go; E, guys; F, guys to hold the heel of C; G, tackles to steer by; H, a stout chock fastened to C; I, bumpkin spar guyed to B.



A, old rudder; B, new rudder; C, rotating spar; D, bumpkin spar; E F, guys to hold new rudder; B B may be of metal, or so loaded as not to be lifted.

As we cannot get down to the heel to secure it, that important function must depend on the guys, E F, Fig. 1, and the guys, F, Fig. 2. All the guys (as well as the spar, D) must be *very rigid*, and are supposed to be of steel wire.

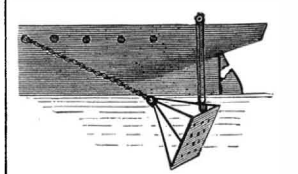
If the weight of the spar, C, did not rest on the chock, H, and on the guys that go to the heel, a very small power would hold the jury rudder, provided the ship always moved ahead; but as the principal surface is abaft the center, it follows that the yoke, D, the chock, H, and the tackle, G, must be very strong to hold on in stern-way. The spar, D, Fig. 1, need not be over 35 or 40 feet long; the coop spar, B, Fig. 2, 50 to 55 feet, and it may be in two pieces; and the spar, C, which I call the rudder stock, may be 24 or 26 feet. Any steamer running on the Atlantic would be furnished, in the shape of yards or topmasts, and trysail booms, with spars such as I have described. *If not, she ought to go to Davy Jones' locker.*

R. B. FORBES.

Milton, Mass., March 24, 1885.

To the Editor of Scientific American:

In regard to the discussion now being carried on in your paper about "How to steer a vessel that has lost the use of her rudder," I would suggest the following simple plan: To a rectangular plate of boiler iron attach rods at each corner, all connecting with a ring. Make a chain or hawser fast to this ring, and lead it through a chock about 80 feet from the stern of the vessel. Attach a tackle to the drag, as shown in the diagram. This tackle will serve both to steady the drag and to lift it out of the water when necessary. The rods could be so arranged that the drag would have a tendency to shoot downward and out from the side of the vessel. By loosening a drag on whichever side it became necessary, the vessel could be after a time worked into some port.



C. A. M.

Ithaca, N. Y.

The New Commissioner.

A Democratic Patent Office Commissioner has been appointed to the place of Mr. B. Butterworth. We are anxious to see how the new man, Mr. Martin Van Buren Montgomery, of Michigan, meets the responsibilities of his important office, under the changed political conditions. Mr. Butterworth gave satisfaction, on the whole, but the general control and management of the department has been the subject of much complaint on the part of inventors and patent attorneys for many years. It is possible that the Democrats will find many abuses deserving correction, and it is to be hoped that they will make the necessary reforms; but they will best assist inventors and advance the manufacturing interests of the country by increasing the staff of the Patent Office and giving it a larger building. At present it is disgracefully undermanned and shamefully housed.

There are about 550 employes, when the number should be at least 1,000, who could all be paid out of the earnings of the Office; and the lack of accommodation may be inferred from the simple fact that the electrical division, with its 6,000 patents and a rapidly growing work, occupies two dismal, small, damp rooms on the ground floor, under which there is no cellar. It is high time that some of the 20,000 cases on hand should be disposed of, and that part of the accumulated $2,000,000 of surplus and of the $200,000 now turned over to the general treasury annually should be devoted to its proper employ. The fact that the whole laboratory of the Office is not worth $500, and that the apparatus in the electrical division consists of only ten cells of Bunsen battery, a small hand dynamo, and two old galvanometers, is enough to arouse any one to fierce indignation.—*The Electric World.*

The Toxic Effect of Insect Powder.

Regarding the method of action of this powder upon its victims, the fact should be kept in mind that the lungs or breathing apparatus of the insect are very different to those of the vertebrate animal. Instead of lungs, as we have, set apart in one portion of the frame, for the definite object of supplying oxygen to the blood after the latter has become in need of it, the insect has a central tube, connected with the air by a row of orifices on each side of its body, from which smaller channels radiate to every part of its circulation. The animal lung demands two systems, as it were, of circulation—the arterial and the venous. The insect has but a single circulation, and the whole of its blood is being constantly and fully brought into contact with fresh supplies of air. Hence the instant and powerful effect of any toxic substance with which the air may be impregnated. Thus an insect may be almost instantly killed by the vapor of chloroform, or ether, or prussic acid. These facts are powerful arguments for the theory that it is the volatile constituents of insect powder which are fatal, and not the actual contact, necessarily, of its particles.

THE following statistics will show what a wonderful fishing center the town of Gloucester, Mass., is. The amount of fish landed at this port during the month of October, 1884, was as follows: Codfish from George's Bank, 2,870,000 pounds; halibut from George's Bank, 13,200 pounds; fish caught on the Cape shore, Nova Scotia, 580,000 pounds; codfish from Grand Banks, 1,370,000; salt halibut from Grand Banks, 9,800 pounds; fresh halibut caught on the Banks, 724,700 pounds; haddock from the Banks, 45,000 pounds; pollock caught in nets, 1,994,000 pounds; codfish caught in nets, 68,000 pounds; and 7 sword fish, weighing 2,218 pounds.

ENGINEERING INVENTIONS.

A car truck has been patented by Mr. Jefferson D. Trammell, of Auburn, Ala. This invention covers the construction and combination of parts to form a railway system for short line railways, in which the car trucks and tracks are made in a novel way to avoid friction from flanges and on sharp curves, and to insure the cars following the tracks.

A steam boiler has been patented by Mr. Henry F. Allen, of New York city. It is made with a hollow shell, with one or more vessels surrounded by the shell and connected therewith, and with water tubes projecting inwardly from the shell and outwardly from the interior vessels, with various other novel features to insure strength and safety, and so steam can be made quickly.

A car coupling has been patented by Mr. Frank Vaughan, of Elizabeth City, N. C. This invention covers a peculiar construction and arrangement of the coupling link and its supporting spring, the drawhead, and the combination of the two on an adjustable frame adapted to be moved to bring either the coupling link or the drawhead to the center line of the car, with other novel features.

AGRICULTURAL INVENTIONS.

A plow has been patented by Mr. Manfred Call, of Richmond, Va. This invention relates to devices whereby the wearing portions of a plow are attached to the standard, and provides means whereby either the point, the landslide, or the mould board may be removed from the post without interfering one with another, and so these parts may be economically attached together without bolt holes through them, the standard being adapted to receive and hold the movable parts in their places.

MISCELLANEOUS INVENTIONS.

A pail has been patented by Mr. Theodore A. Cook, of Brooklyn, N. Y. This invention consists principally in providing wooden pails or buckets with a specially devised metallic bottom, whereby the pail is made very light, strong, and durable.

An improvement in hames has been patented by Mr. Nicholas G. Schwalen, of Minneapolis, Minn. By means of a screw journaled in eye plates secured to the hame, an adjusting device is so operated that the trace may be fixed at a point higher or lower, as desired.

A fabric turfing implement has been patented by Mr. Charles M. Hinkle, of Davis City, Iowa. This invention relates to hand implements for making rugs, etc., and has certain novel features for the regulation of the depth of the looping of the material that forms the nap of the fabric.

A side bar for buggies has been patented by Mr. Robert St. Clair, of Veedersburg, Ind. It is composed of a wooden portion and a bottom plate secured thereto, in connection with specially adapted springs, and other novel features, so that the side bar is made very strong and well adapted to hold its shape.

A cigar perforator has been patented by Mr. Leandro C. Michelena, of Brooklyn, N. Y. This invention covers a novel device for piercing the closed or tip ends of cigars before lighting them for smoking, one which may be quickly and easily used, and without danger of breaking the wrapper of the cigar.

A brick has been patented by Mr. William Heard, of Brooklyn, N. Y. It has a central aperture and intersecting longitudinal and transverse grooves on one of its faces, the object being to thus provide bricks which will form a stronger and better wall, and which can be dried and burned in less time and with less fuel than ordinary bricks.

An ice cutting machine has been patented by Mr. Isaachar Crowfoot, of Hartford, Wis. This invention covers improved mechanism for working circular saws for ice cutting, also mechanism for moving the machine about on the ice, and for cleaning the ice of snow in advance of the saws, the whole being operated by steam power mounted on the machine.

An end gate fastener has been patented by Mr. Bengt J. Swenson, of Sugar Land, Tex. This invention consists in a hook ended lever buckle for drawing up and fastening the ends of chains on presses, wagons, etc., the hook end being caught in the chain and the handle portion then turned down, which draws the two ends of the chain together and fastens them.

A motor, to be operated by weight and drum, has been patented by Mr. William J. Allen, of Norborne, Mo. This invention covers an apparatus comprising a weight and drum, multiplying train, and a regulating escapement, for a motor to operate a pump or other device, making a simple and effective power for use where windmills could not be conveniently placed or profitably employed.

A nut lock has been patented by Mr. William S. Clymer, of Westerville, Ohio. This invention covers a special construction and combination of parts according to which a lock nut stops the main nut, a key stops the lock nut, a wire stops the key, and bends in the wire to stop it from removal, so that neither bolt nor nut will be damaged, and the nut is positively secured and closely locked.

An apparatus for separating oil vapors has been patented by Mr. John E. Bicknell, of Cleveland, Ohio. This invention consists in a special construction to insure the certain condensation of the vapors of heavy oil, while the vapors of lighter specific gravity pass off separately, and there are also means for accurately regulating the temperature of the condenser at all times.

A wagon tongue support has been patented by Mr. William R. Spray, of Ingraham, Ill. It is made with a chain or cord held to the forward running gear on the wagon, and passing over a spring held to the tongue to a flange or plate having a series of holes, and fixed to the tongue in front of the spring, which holds the tongue at its outer end to any desired height.

A stencil holder has been patented by Mr. John J. Callow, of Cleveland, Ohio. It is for a graining stencil plate, and has a handle piece with a clamp lip or flange for seizing one edge of the plate only and holding the plate out bodily thereby, with other novel features, so thin or flexible materials may be used for the stencil plates, and ties for strengthening them may be dispensed with.

A siding gauge has been patented by Mr. James H. Jenkins, of Thomasville, Ga. This invention covers a special construction and combination of parts for improving gauges whereby weather boards may be marked to be sawed off as desired, and so two ends may be held at one time ready to be nailed on at the proper distance from a given line or from the edge of a previously fixed board.

A process of purifying metals has been patented by Mr. Charles Edwards, of Paris, France. The metals to be treated are placed in suitable retorts, hermetically closed by covers with sealed joints, and then subjected to a current of moist hydrogen, previously passed through one or more baths, in order to take from the metals all or a part of the metalloids which deteriorate their quality for practical uses.

A grease cup has been patented by Mr. William Schoendelen, of Davenport, Iowa. In combination with an inverted cup is a piston adapted to hold a body of grease above it, and a downwardly projecting feeding tube in open communication at its upper end with the grease space in the cup above the piston, whereby the weight of the cup is made to force the grease down the tube to the part to be lubricated.

A buckle has been patented by Mr. Charles R. Harris, of Cortland, N. Y. It has a fixed, hollow, toothed bar, with teeth along both edges, for use in connection with a presser bar forming part of the folding portion of the buckle, and arranged to press the web of the strap to which the buckle is applied between and against the double row of teeth, to insure a perfect fastening of the buckle.

An improvement for stoves and heaters has been patented by Mr. Thomas J. Trew, of Kirksville, Mo. It is a contrivance for making the top of the stove or heater of a deeply corrugated plate of thin metal, to provide a much larger radiating surface; there is also provided an outside hood, and a deflector plate beneath the corrugated top, connecting the indentations in the top plate.

A carpet fastener has been patented by Mr. John Pearsall, of New York city. It consists of a metal plate with a keyhole slot, and depressed along its middle portion adjacent to said slot to receive the head of a carpet nail, the remaining portion of the edge of the plate being elevated at a uniform height around its entire circumference, so that the carpet cannot be torn, and can be quickly taken up or put down.

A surgical chair has been patented by Mr. George Weber, of Brooklyn, N. Y. Combined with a chain seat and base are crossed pivoted legs, a segmental rack held on the pivot of the legs, and a pawl pivoted to the seat and resting on the rack, with other special features, to provide a chair which can be readily adjusted in height and locked in position, and the leg and back rests of which can also be easily adjusted and locked in place.

A surveyor's instrument has been patented by Mr. John H. Dolman, of Albany, Texas. It consists of a protractor with right angled piece and straight piece pivoted to move independently on the protractor, the inside edges of the right angled piece being spaced and numbered from 1 to 200, and carrying levels on its upper and lower sides, while the straight piece, which carries a telescope, is correspondingly spaced and numbered up to 360, the whole making a convenient instrument for surveyors for measuring angles and plotting.

A carpet stretcher has been patented by Mr. John J. Taylor, 2d, of Warren, Pa. Combined with a grooved bar is a sliding rack, the rack having its front end pivoted on the bar; a U-shaped frame, having at its ends pointed heads for holding it in place, is provided with a wire or rod which serves as a fulcrum for the lever which is engaged with the teeth of the rack, and is used for moving the rack in the direction of its length.

A lock for worm fences has been patented by Mr. Joseph J. Iglehart, of Columbia, Mo. The invention consists in the combination, with the panels of a worm fence, of binding rails crossing the top rails of the panels, and wires passed around the rails of the panels and the adjacent binding rails, whereby the rails of each panel and the successive panels will be firmly bound together, so the fence cannot ordinarily be pushed or blown down.

A double acting water wheel has been patented by Mr. Charles W. Rau, of Allentown, Pa. This invention covers a novel construction of double acting wheel, where the water so acts upon the inclined blades and flanges of the wheel that two shafts are moved thereby in opposite directions, the motions being made similar by using one crossed belt in conjunction with a straight belt to carry the power to main driving pulley.

A mail bag has been patented by Messrs. Michael F. Stellwagen and Alton A. Lytle, of St. Ignace, Mich. This invention covers a mail pouch fastening formed of a four part frame hinged so as to fold closely together along opposite sides of the pouch, and having grooves into which the knuckles of two of the hinges pass, and with holes at one side of the folded frame for studs fixed at the opposite side, with other novel features.

An awning has been patented by Mr. William A. Nelson, of Omaha, Neb. Combined with two pairs of crossed and hinged legs is a board resting in the fork of the legs above the hinge joint, an awning having a ridge pole, and vertical posts located above the joint of the legs and stepped upon the board and distending the ridge pole, making an awning that is very light and strong, and easily put up and taken down and folded for transportation.

A vehicle spring has been patented by Mr. John J. Kalina, of Collinsville, Ill. It has anti-friction rollers interposed between its opposite sections and elastic buffers or cushions to limit the end motion and prevent shock and noise, with other details, the upper and lower members being movable lengthwise on each other, so the body of the vehicle will be free to adjust or level itself crosswise independently of the running gear.

A process of manufacturing perforated metallic goods has been patented by Mr. John J. Callow, of Cleveland, Ohio. This invention provides a method of producing a plate of perforated metal for graining, frescoing, or other ornamental or printing purpose, by means of electro-metallurgy, the pattern being formed by the sand blast, wheel grinding, or acid etching, in glass, porcelain, etc., so that thousands of copies of any required design can be readily made.

A treadle motion for velocipedes has been patented by Mr. George H. Griffiths, of New Rochelle, N. Y. The axle to which the wheels are secured has opposite cranks to which the treadles are attached by links, the foot movement being rendered natural and easy, to resemble the action in walking, by means of links and springs, the dead center being avoided, and the motion being downward and backward and upward and forward.

A fifth wheel for vehicles has been patented by Mr. Thomas Smith, of Breckenridge, Mo. According to this invention, the head block is braced by a peculiarly constructed plate, which also supports the coupling from strain when the axle rises high enough for the bed to strike the head block, giving such flexibility that the front wheels go over small obstructions without causing any jar or movement at the coupling, and the hind wheels as they rise rock the coupling pieces in the boxes, thereby easing the twist and strain.

A saw jointer has been patented by Mr. George H. Mayer, of Kansas City, Mo. It has a frame with opposite arms spaced apart to admit the saw blade and connected by a head piece, one of the arms having guide studs on its inner face to prevent contact of the frame of the jointer with the saw teeth at one side, and the head portion of the implement having a tri-form recess made in it, so either a three cornered or a flat file may be held, and the teeth may be evenly and accurately jointed without spoiling the "set."

An automatic stop plug for gas and oil pipes has been patented by Mr. William F. Cosgrove, of Jersey City, N. J. Combined with a coupling having a tapering socket and apertured removable cap is a plug with a slotted stem passing through the aperture of the cap, a fusible key passing through the stem on the outside of the cap; the plug can be drawn up snugly against the cap by a set screw passing in through the upper end of the stem and resting against the fusible key, the object being to prevent the flames in burning buildings being fed by gas or oil escaping from broken pipes.

NEW BOOKS AND PUBLICATIONS.

HILFSBUCH FUR DEN SCHIFFBAU (HAND BOOK OF SHIP BUILDING.) By Hans Johow. Berlin: Julius Springer, 1884.

This interesting and valuable work is divided into five parts, viz., I. General Tables. II. The Theory of Ship Building. III. The Practical Part of Ship Building. IV. Mechanism and Machinery for Propelling Vessels. V. The Marine Law. The mathematical tables, tables of weights and measures, the several formulas for constructing curves, the different methods of making calculations, the descriptions of the engines, boilers, rigging, chains, boats, pumps, and the armament of vessels, the methods of launching, docking, etc., are all given with the most minute care and attention. One of the special features of this work is the general arrangement. All the parts are arranged in systematic order, and in such a manner that any one of the parts desired can be found instantly. Nothing is lacking to make this a perfect hand book for ship builders, and it is only to be regretted that the work has not been published in English. In numerous notes, the titles of the different works of reference are given, thus enabling the reader to refer to such works in case he desires further or more detailed information. The work is provided with ninety-six cuts and two lithographic plates.

Business and Personal.

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

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter,** should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) H. C. P.—You may generate 237 cubic feet of steam from one cubic foot of water at 100 pounds pressure.

(2) J. W. H.—Any one can readily make a microphone by following instructions given in our SUPPLEMENT. We do not know that they are regularly manufactured.

(3) J. B.—Your dynamo, if made according to instructions given in SUPPLEMENT, should operate two or three small incandescent lamps.

(4) A. J. H. asks how to burnish an agate. A. By polishing it with crocus.

(5) G. W. S.—Two cigar boxes connected by a string or wire cable cord form an acoustic telephone which works very well, and is not covered by any patent.

(6) H. B. P. writes: I have an Edison incandescent lamp, 6 candle power; what kind of a battery do you think is the best? A. Use 10 or 12 cells of Bunsen.

(7) W. H. V. R.—A dipping needle is sometimes employed to search for iron, but the other metals have no effect on it. No reliable instrument for indicating the precious metals has been invented. You can purchase a dipping needle from any of the dealers in philosophical or mathematical instruments who advertise in our columns.

(8) O. V. A.—A volt is the unit of the current, and is about equal to the current delivered from a Daniell's cell. An ampere is one volt delivered through one ohm for one second, and is the unit of work.

(9) C. T. A. writes: Our citizens are making an effort toward the establishment of manufacturing enterprises here (in Kentucky), and purpose sending out an agent to visit some places where small manufactures are carried on. What would be good places to visit? A. It is probable that you will find more small industries within a radius of 50 miles from New York city than anywhere else in this country, and by visiting them you could get some idea of what you want. We think that a visit to some of our large dealers in wooden ware, notions, etc., would be instructive, and might lead to business. There are many small shops in Connecticut which might be visited with profit. We believe that South Bend, Ind., is noted for the manufacture of wooden articles, particularly parts of wagons and carriages. There is of course a large variety of manufacture which you might carry on profitably, provided you get the very best and most modern tools and appliances.

(10) A. L. L. asks: 1. About how expensive are the various Geissler's tubes, such as are used in electrical exhibitions, and where can I procure them? A. Geissler's tubes cost from 75 cents to $50 and upward, each; such as are ordinarily exhibited, 6 to 8 inches long, cost from $1 to $2 each. You can purchase them from dealers in philosophical instruments. 2. How much and what kind of battery power would be required to work five or six tubes? A. Two or three cells of Bunsen or the plunging bichromate battery. 3. Is it necessary to use an induction coil with the battery? If so, what size? A. Yes. One that will yield an inch spark answers very well indeed. A very small one will show one or two small tubes. 4. Where can I procure electric jewelry? A. From dealers who advertise in our columns.

(11) R. W.—We think you will not be able to construct a baker's oven from the raw clay. The clay shrinks so much that the arch would be likely to break down. Better mould and burn rude bricks or slabs of clay, from which build the oven.—See SCIENTIFIC AMERICAN SUPPLEMENT, No. 59, for illustration of a flexible harrow, or address makers of agricultural machinery.

(12) J. S. asks: 1. Is it practically possible to run a dynamo, produce by it an electric current, and heat, fuse, and sublime metals by that electric current, all *in vacuo*? A. Yes, in such vacua as we are familiar with. What an absolutely perfect vacuum might do we cannot say. 2. A friend of mine contends that electricity and its operations are impossible without the presence of oxygen, that oxygen is an essential developer of electricity. A. We do not think oxygen is vital to the generation or utilization of electricity.

(13) P. J. M.—Ivory is bleached by exposing to sunlight. It takes in this way from one month to six months. Exposed to sunlight under a light cover of turpentine, the bleaching may be done in three or four days.

(14) S. J. R.—The only practicable way of getting the tanning qualities of hemlock bark in a concentrated state is by grinding and leaching and then evaporating, as bark extract is regularly made. A few of the makers of bark extract take off the ross, or rough outside portion of the bark, before grinding, but the most of them grind and leach the whole of the bark as taken from the tree.

(15) T. N. C.—Naphtha, coal oil, and petroleum have all been used on locomotives and under stationary boilers, with varying success with locomotives, but with stationary boilers; an entire success. For valuable articles on petroleum and its derivatives as fuel, see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 331, 63, 403, 119. For equal weight, petroleum has twice the evaporative power of coal.

(16) J. F. S.—The assertion of interested parties relative to the wonderful strength of beton should be taken with several grains of allowance. Although trial tests have shown great strength, it is not reliable for arches without provision for thrust, to any greater extent than ordinary stone in a monolithic form.

(17) O. M. B. writes: I have an engine located 25 feet from the line shaft it drives. Will I gain or lose power by increasing the distance to 50 or 60 feet? A. 50 or 60 feet between centers is considered too long a distance for satisfactory running of a belt. The vibration gives a jerky motion to the shafting. The absolute loss of power is very little.

(18) A. D. C. asks the diameter and focal length of the objective to a Galilean telescope that shall have the same power and same field of view as an achromatic astronomical telescope whose objective is 3 inches in diameter and 48 inches focus, giving a power of 240? Also, what kind of lens is the best for the objective in a Galilean telescope? A. The field is very small in a Galilean telescope. You will require a glass of 3 inches diameter, 20 feet focal length, for an approximation to the power you mention, using a 1 inch focus eye glass. The glass should be as perfect as is required for achromatic objectives. We do not recommend this form in our advanced age.

(19) F. J. K.—The most approved way of deafening a roller skating floor, if in a building with a floor already laid, is to lay a set of light beams on rubber (pure gum) bearings upon the old floor and fill in with saw dust, then lay the skating floor on the light beams. In making a new floor, two sets of beams may be laid, one set a few inches higher than the other; lay roofing felt upon the upper beams, and the floor upon that. The lower beams may be lathed and plastered or felted and ceiled with boards.

(20) A. G.—Telegraph instruments are polished and lacquered. You cannot clean the parts with acid to any advantage. The best way is to take the instrument apart and clean off old lacquer with alcohol, then polish all the parts with rotten stone and oil on leather, pine stick, string, or anything that will reach the various parts. Then thoroughly clean with a cloth wet with alcohol, and lacquer with thin shellac varnish, using a flat camel's hair brush. Remove japan by burning off, or dissolving the varnish in naphtha. We do not know of any metal that will expand and contract as you desire under the influence of an electric current.

(21) F. E. F. writes: On page 188 of Mitchell's Manual of Assaying, it says: "Niter has a very powerful action on the sulphides, and where an excess of niter is used, all the sulphur is converted into sulphuric acid." Again, in Aaron's work on Assaying (published by the Scientific Press), it says on page 32, niter is a desulphurizer in two ways: First, by giving off oxygen to burn sulphur; secondly, by the potassium combining with sulphur, as the sodium of soda does; but if enough niter be used, all the sulphur is burned, being converted into sulphuric acid. I claim that sulphur never burns to *ic*, but always to *ous*, thereby forming sulphurous acid, and not sulphuric. A. According to Watts, anhydrous sulphuric acid (SO_3) "is formed by the direct oxidation of sulphurous oxide" (SO_2), and therefore we see no reason for not accepting the statement of Mitchell, especially as the present edition has been revised by so careful and competent authority as Professor William Crookes.

(22) F. G. D. asks what the chemicals are, and in what proportion they are mixed, for making blue lines on white paper. Also give the receipt for Pellet's plan. A. The process desired by you is given in answer to query 45 in the SCIENTIFIC AMERICAN for January 27, 1883. In the Pellet's process the copying paper is sensitized by immersion in a bath formed of 100 parts of water, 10 of iron perchloride, and 5 of oxalic acid. The drawing, on transparent paper, is placed on a dry sheet of the copying paper, and exposed to the light under the glass. After exposure the sheet is placed in a bath of potassium ferrocyanide (15 to 18 per cent of water), which immediately colors blue all the parts where the perchloride has remained intact, but does not affect the parts where the salt has been reduced by light. Then the drawing is washed with water and passed into a bath of 8 to 10 per cent of hydrochloric acid, which removes the salt of protoxide of iron; then it is washed again and dried.

(23) H. H. U.—White lead produced by the Dutch process is said to have a higher specific gravity than that produced by other methods. A description of this process is given in standard works on chemistry. It is too lengthy to be reproduced here. Chromium sesquioxide can be obtained by heating a mixture of potassium dichromate with sulphur or sal ammoniac and lixiviating the residue. That which distills over from crude petroleum below 100°C. is called petroleum ether. The red oxide of iron is found native, and can be obtained by heating iron sulphate. The plaster of Paris for your crucibles must be mixed with glue or starch water to prevent cracking.

(24) W. H. D.—If you desire to become a mechanical draughtsman, it will be best for you to attach yourself to some engineer's office. Or if you desire to follow art, then you should study in the studio of some artist.

(25) W. M. G. asks: 1. What kind of a glue or cement is used to fasten rubber on band saw wheels? A. Such a cement is best made by a solution of shellac in ammonia. This is prepared by soaking pulverized gum shellac in ten times its weight of strong ammonia, when a slimy mass is obtained, which in three to four weeks will become liquid without the use of hot water. This softens the rubber, and becomes, after volatilization of the ammonia, hard and impermeable to gases and fluids. 2. What preparation is used to glue or secure sand on a sand belt? A. Use strong glue size; the sand can be procured from any druggist or grocer.

(26) C. M. R. asks (1) recipe for making camphor ice in small quantities for home use. A. Melt together over a water bath, white wax and spermaceti each 1 ounce, camphor 2 ounces, in sweet almond oil 1 pound, then triturate until the mixture has become homogeneous, and allow one pound of rose water to flow in slowly during the operation. 2. Recipe for making instantaneous ink and stain extractor. A. Take of chloride of lime 1 pound thoroughly pulverized and 4 quarts soft water. The foregoing must be thoroughly shaken when first put together. It is required to stand twenty-four hours to dissolve the chloride of lime; then strain through a cotton cloth, after which add a teaspoonful of acetic acid to every ounce of the chloride of lime water. 3. Recipe for making ink that I can use on a copy book with a press. A. See recipes given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 157. 4. Recipes for making a roof paint waterproof, for painting old tin roofs, something that will last and is good. A. You will find this information in SCIENTIFIC AMERICAN SUPPLEMENT, No. 113. 5. What city in the United States are eggs manufactured in, or if they are manufactured? A. Eggs are not manufactured at all.

(27) L. S. T.—The direction, curve, or apparent twist of liquids running from faucets is governed by the shape, form, or roughness of the nozzle as well as the shape of the opening made by turning the plug.

(28) C. M. W. asks: 1. Will 2,000 cubic feet of water with a 20 foot fall be any more effective on a 40 foot breast wheel than over a 20 foot overshot wheel? A. Where there is no liability to back water obstruction under the wheel, we believe the overshot wheel the most effective with a limited supply of water, as there is in a well constructed overshot but little leakage, although the bottom spill indicates a small loss on the total effect. 2. The total weight of a vessel is 100 tons. What is the least number of tons of water that will float her, provided she is set into a tank of water? A. The quantity or weight of water required for floatation depends entirely upon the perfection of fit of the inclosing case. It might take one ton or fifty.

(29) I. B. H. writes: Supposing a steam launch engine with a cylinder 4 inches by 6 inches to make 300 revolutions per minute (filling and emptying itself 600 times per minute), with a boiler pressure of 50 pounds per square inch, whatever would be the average effective piston pressure, what amount of water would the steam used represent? Also how much water would be used (at same number of revolutions) at 100 pounds pressure? In a word, how much more water would be in the steam at 100 than at 50 pressure? Ordinary slide valve, and steam from vertical tubular boiler. A. You will probably have a mean piston pressure of 40 pounds, which will require nearly 3½ pounds of water per minute. If you carry 100 pounds pressure, you may have 80 pounds mean piston pressure, which will require 5½ pounds of water per minute.

(30) L. M. G.—Do not try to cast brass in plaster of Paris; fine moulding sand is the proper material. To weld iron pipe, scarf the ends to be welded so that they will lap about ¾ inch to 1 inch according to size. Make the scarfs so that when put together they will be somewhat larger than the diameter of the pipe, which will enable you to finish the weld the same size as the pipe. Place the scarfs together in the fire, heat to welding, tap the end of the pipe gently to give them contact, and hammer the scarfs with a light hammer in the fire, turning the pipe over as you hammer. A little sand or borax helps the weld.

(31) F. A. M. writes: I have charge of 6 miles of track on a north and south road, and I find that 90 per cent of the iron worn out is on the west side of track. Can you assign the reason for wearing a greater per cent on west side than on the east? A. Your observation is a very curious one, and if this fact could be proved universally on north and south roads, would stand as a very pretty practical demonstration of the rotation of our earth. The wear you speak of must be due to the uneven loading of your freight cars or to the fact that the rotation of earth on its axis from west to east throws the greater weight of the cars on the west track, causing a greater wear of same. Mr. P. H. Dudley of the dynograph car, and who has examined the principal railroads in this country, informs us that he has not discovered that under normal and equal conditions the wear of west rails in north and south roads is greater than that of east rails. Further facts in this matter would be of interest.

(32) N. J. W. asks: 1. Is there any method of extracting fossils from compact rock? A. There is no way known to us for obtaining clean fossil prints, but care in splitting the rock. When a fossil is but partially exposed in the splitting, the overlying stone has to be carefully chipped off with a small chisel and hammer until the desired uncovering is procured. In some kinds of rock that are soft a small sharp graver chisel in the hand is all that may be needed. No solvent will answer. 2. Why is dew deposited only on the tip of a blade of grass? A. The tips of the blades of grass are most exposed to the effects of radiation, and become colder than the lower part. The dew gathers upon the coldest part. 3. What is the powder used to make perfumed cigars? A. This depends upon the kind of perfume desired. In cinnamon cigars the bark is pulverized and sprinkled upon the moist stock. Many essential oils are used by spraying upon the filling of the cigars.

(33) H. C. G. asks how to make strong vinegar of cider made last summer. This cider was put in stone jars and glass demijohns, and has been racked off once. It has been stored in basement, the average temperature of which is in winter 50° Fahr. Some of it was put in the sun for weeks, but none of the cider has turned to vinegar. How can the "mother" be made to form in barrels of cider? Can vinegar be made either in brandy or whisky barrels? A. The action of the atmosphere with time at a temperature of 70° to 85° F. will produce a satisfactory cider. The above conditions will bring about the formation of the mother. Some prefer to add a little true cider vinegar to the fluid, but this is not strictly necessary. Dip a piece of coarse paper in molasses and place it in your vinegar barrel. It is immaterial as regards the barrels. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 392, on "How to Clarify and Purify Vinegar."

(34) F. H. C. asks the formula for making a solution of citrate of magnesia.

A.	Carbonate of magnesium	200 grains.
	Citric acid	400 "
	Sirup of citric acid	1200 "
	Bicarbonate of potassium in crystals,	30 "
	Water a sufficient quantity.	

Dissolve the citric acid in 2,000 grains of water, and, having added the carbonate of magnesium, stir until it is dissolved. Filter the solution into a strong 12 ounce bottle, containing the sirup of citric acid. Then add enough water, previously boiled and filtered, to nearly fill the bottle, drop in the bicarbonate of potassium, and immediately close the bottle with a cork, which must be secured with a twine. Shake the mixture occasionally until the bicarbonate of potassium is dissolved.

(35) C. T. A. asks: What kind of oil can be made of bones (beef or hog), and how the oil is made? A. Bone oil, variously known as Dippel's oil and animal oil, is obtained in the dry distillation of animal gelatinous substance. All that is now found in commerce is recovered as a product of distillation during the calcining of bones for the preparation of animal charcoal or boneblack. It is only valuable as a coarse lubricant. The method of manufacture is described in technical works.

(36) A. J. M. asks: Is there any preparation by which you can take a natural flower and dip it in, that will preserve it? A. Dip the flowers in melted paraffine, withdrawing them quickly. The liquid should only be just hot enough to maintain its fluidity, and the flowers should be dipped one at a time, held by the stalks, and moved about for an instant to get rid of air bubbles. Fresh cut specimens free from moisture make excellent specimens in this way.

(37) L. M. B. writes: I have several upright oil tanks (cylinders), some having round or dished bottoms and others cone-shaped. I wish to know their exact capacity, and the difficulty I find is to get the capacity of the round and cone-shaped bottoms. Please give me a rule whereby I can measure them. And also how to find the capacity of a globe. A. For the volume of a cone: Multiply the area of the base by the height; one-third of the product equals the volume. For the volume of the segment of a sphere: To 3 times square of the radius of its base, add square of its height; multiply this sum by height, and product by 0·5236. For the volume of a sphere: Multiply the cube of the diameter by 0·5236.

(38) W. H. R. writes: I want information in regard to the preserving of fruit, eggs, etc., by cold storage or in cold storage rooms, as it is called, I believe. A. Cold storage consists simply in the placing of perishable articles of food in a room artificially cooled. Generally the room is cooled by passing air over ice, and then allowing it to enter the room from above, but air can be cooled by other processes and used with equal advantage. The room is also carefully built in such a way as to prevent the entrance of hot air, the doors fit tightly, and there is generally an ante-chamber through which one enters.

(39) F. W. B. writes: How much power would I get from a round brick structure thirty feet across, with an inner wall eight feet from the first, surmounted by an iron horizontal wheel thirty feet across similar to a windmill, and letting the heat from fires in the annular space between the walls strike against fans of wheel, on the principle of the smoke jack? Would this principle, modified by best forms of draught chimney, grate, etc., give any practical result? A. No. For so large an apparatus you could scarcely overcome the friction of the wheel with any natural draught that you could produce.

(40) H. M. B. writes: During a conversation, I made the assertion that there are running engines in England to-day having no cabs on same. Is is not a fact? A. Very few of the English engines are provided with cabs, as ours are.

(41) E. S. N.—Steam under sudden compression evolves heat the same as air and the gases. If the pressure can be carried to near 2,000 pounds without loss of heat, the steam would be condensed into water at a red heat.

(42) W. H. J.—There are some 16 or more lead smelting works in the United States at present, the most important of which is at Newark, N. J. The duty on pig lead is 2 cents per pound, and on lead ore it is 1½ cents per pound. Pig lead is worth from $3.50 to $3.70.

(43) D. C. asks: Is any advantage gained in burning hard coal moistened or dry? Would you recommend coal constantly moistened in a self-feeder coal stove? Or do you think best to burn the coal dry? A. There is no advantage, but a decided loss, in burning wet coal. The heat consumed in vaporizing the water is lost. The vapor itself is of no value, as it only imparts the heat that it has received from the coal. The water used to cake soft coal and its dust is only a mechanical expedient to utilize what might otherwise be wasted by sifting through the grate unburned.

(44) H. T.—For polishing black marble, use oxide of tin. It does not stain. Woolen cloth or felt (an old felt hat) for the rubber.—There is no difficulty in belting fore and aft in a building 21x94. Put your engine belt wheel in the central part of the room, so that the belt wheel will be next the wall, then belt forward on to a main shaft and also backward on to a main shaft, and from each of the main shafts carry belts to the front and rear. This is a common practice here.

(45) W. H.—For a full illustrated description of how to set a slide valve see SCIENTIFIC AMERICAN SUPPLEMENT, No. 13.

(46) W. J. S.—Steam flows into a vacuum from 60 pounds pressure at the rate of about 1,600 feet per second. From 60 pounds pressure into air steam flows at the rate of 795 feet per second. So that, if there is very little friction and the ports are large, there can be little difficulty in getting a piston speed of fifty to sixty feet per second for an eight inch stroke, provided you can overcome the reaction of the crank.

(47) J. H. T. asks: About what is the momentum, in foot pounds, of a train consisting of a locomotive and six passenger cars, with their complement of passengers, traveling at the rate of thirty miles per hour? A. About 500,000,000 foot pounds.

(48) E. C. writes: Can I return condensed steam to boiler from heating pipes by gravity when using 50 or 60 pounds steam? A. Yes; provided you keep the full pressure on the pipes or coils, so that the water will return by gravity. It may require 8 or 10 feet height from bottom of coils to water line in boiler to effect a return. If steam pipe is large, it can be done with less height.

(49) Artisan asks: About how many cells of the Bunsen battery would it take for an electric lamp equal to about four common kerosene lamps? Also what number SUPPLEMENT contains directions for constructing? A. For an arc light, from 25 to 30. For one incandescent lamp, three or four times that number of cells. For description of various batteries consult SUPPLEMENT, Nos. 157, 158, and 159.

(50) J. M. F. asks for a simple formula for the cure of kidney disease. A. Lithia water may alleviate, but we cannot recommend anything to cure.

(51) W. A. S. O.—Mechanical and electrical skill and education are both necessary to the profession of electrical engineering. There is always room at the head of every profession or business. We can hardly advise you as to the best business for you to follow. We would say, however, that it is best to choose the one most in accord with your tastes and inclinations. We know of nothing better than a heavy wrapping of felt to keep ordinary water pipes from freezing.

(52) D. H. M.—Rubber is not soluble or softened by water. An inferior quality of rubber goods is made by melting old rubber and mixing with new rubber.

(53) W. H. M. sends a sketch of a peculiar form of magnet devised for a special purpose, having a hollow core with a valve for the armature, and asks if this construction is practical? And what power or how many pounds lifting force will such magnet have, that is, how much force will be required to separate the armature from contact with magnet with medium battery power? What size wire should be used to form the coil, and what battery would give the best results, that is, hold the armature in contact the strongest? He wishes to use the hollow magnet as shown to pass air through, and to control the valve by a current of electricity. A. You can get almost any power you wish in your magnet; but you are probably aware that the attractive power of the magnet is inversely as the square of the distance, so that when your valve leaves its seat the power of the magnet over it diminishes very rapidly. You do not say what pressure you desire to hold the valve against. A magnet made like your sketch and wound with No. 16 wire should hold the valve against a total pressure of from 100 pounds to 200 pounds, with a suitable battery. For continuous use, it is probable that a Bunsen battery of the bichromate form would be best. For a magnet of the size shown, you would require from 4 to 6 cells.

(54) L. & B. ask how to make a paste or mucilage to fasten labels on tin. A. Soften good glue in water, then boil it with strong vinegar, and thicken the liquid, during boiling, with fine wheat flour, so that a paste results; or starch paste, with which a little Venice turpentine has been incorporated while it was warm.

(55) J. R.—Leather is usually bleached with an acetate of lead and sulphuric acid. Those who bleach leather in this way say its strength is not injured by this treatment, but we should say it was, though possibly in only a slight degree, according to the manner of treatment.

(56) W. W.—The paste used for papier mache process of stereotyping is regular flour paste, very finely divided, but some of the stereotypers add thereto something to prevent burning when one mould is used to make a great many plates, and this is considered a trade secret. We know of no book published especially on stereotyping.

(57) D. W. asks where to dispose of old shoes and old leather. A. There is no market for old shoes as far as we know. To a limited extent they are used for the preparation of animal charcoal, but in such cases they command only a very low figure.

(58) S. H.—Permanent magnets are made by the contact of tempered steel with an electro-magnet, or by enclosing the tempered steel in a coil, then sending a current through the coil. Ganot's Physics would be a good book for you.

(59) W. S.—See article on Induction Coil in SUPPLEMENT, No. 160, for making sparks to light gas. You will be able to make an electric motor by following directions for making a dynamo electric machine given in SUPPLEMENT, No. 161. For a motor you could make the field magnets smaller. You should also wind the armature with coarse wire, say No. 16.

(60) L. H. T.—We know nothing of the composition of the ink mentioned by you. Its not drying is due to the glycerine, from which it receives the copying quality. You can obviate this difficulty by dilution. You will find in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 157, numerous receipts for the manufacture of ink, some of which may be more satisfactory than the article you are now using.

(61) W. H.—Leather scraps are worth but very little unless large enough to make something from. The leather is used up so closely in some of the Eastern shoe manufactories that such refuse as is left is burned. A very little of it is made into pulp for leather board, but it is not good for this purpose, for which rawhide cuttings and skivings from tanneries are more used, with a great proportion of hemp or jute fiber. Large pieces are made into heels, and some into "pancake" leather, a very inferior, nondescript article used for innersoling in some cheap shoes.

(62) W. G.—Both the heliotrope and the blood stone are used in limited quantities by manufacturing jewelers. Write to Tiffany & Co., of New York, and they will furnish you with detailed information in regard to their value.

(63) J. O. P. desires for experimental purposes a substance of consistency and nature of paraffine or beeswax, which is transparent in pieces say one-sixteenth or one thirty-second inch in thickness. Must be insoluble in water. Can you tell me how to make a composition which can be readily melted, of the fiber and toughness of beeswax? Or can paraffine be made transparent in plates one-sixteenth inch in thickness? A. If you are unable to procure paraffine of the desired nature, we would recommend trial with the sheet wax used for the manufacture of wax flowers. This comes in thin sheets, and can be procured from any dealer in artists' materials.

(64) D. J. C. desires a receipt for making blue-black writing ink (it looks blue in the bottle but turns black after writing). A. Take 1 pound bruised galls, 1 gallon boiling water, 5½ oz. ferrous sulphate (green vitriol) in solution, 3 ounces gum arabic, previously dissolved, and a few drops of an antiseptic, such as carbolic acid. Macerate the galls for twenty-four hours, strain the infusion, and add the other ingredients. When this is completed, mix it with a strong solution of fine Prussian blue in distilled water. Numerous other formulæ are given on page 2498 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 157. We are not familiar with the exact composition of the ink in question, but the foregoing will yield an excellent article.

(65) E. H. asks: Will you please give me receipt for making liquid polish for ladies' kid shoes or leather bags, that will not injure the leather and that will give it jet black polish on any colored leather? A. Use the following: Digest 12 parts shellac, white turpentine 5, gum sandarac 2, lampblack 1, with 4 parts spirits of turpentine and 96 of alcohol, or use linseed oil in which a drier such as litharge has been boiled, with sufficient lampblack for coloring. The latter is used for making enameled leather.

(66) C. C. C. desires a receipt for making the composition used in the hektograph. Also a receipt for the certain kind of black ink to be used. A. For the hektograph, take 4 ounces of good carpenter's glue, soften it in very cold water by soaking it for an hour or two, remove when entirely soft, then heat four ounces by weight of glycerin till vapor arises from it, then add the glue to the hot glycerin, and stir till dissolved: then keep the vessel in a water bath for several hours till the excess of water is evaporated. The black ink to be used consists of a strong aqueous solution of soluble aniline black (nigrosine) in the proportion of about one to five or seven of water. It must be a saturated solution, and rather thick.

(67) C. V. C. desires a formula for transferring printed pictures from the paper on to wood or glass. A. Take a saturated alcoholic solution of potash, pour the solution on the printed picture and immediately remove all the superfluous liquid by means of blotting paper. Lay the picture while damp upon the wood or other material to which it is to be transferred, and place it in a press (a copper plate press is best). The transfer will be made immediately. The picture must be immersed in clear cold water after removal from the potash bath and before putting it in the press.

(68) H. B. B.—Use as cherry stain: rain water 3 quarts, annatto 4 ounces, boil in a copper kettle till the annatto is dissolved, then put in a piece of potash the size of a walnut; keep it on the fire about half an hour longer, and it is ready for use. In regard to preserving the head of a fish, we would refer you to some taxidermist. To polish a pair of steer's horns, first scrape, then rub with emery cloth, and treat with pumice stone and a little oil, and finally polish with Vienna lime.

(69) Acmon asks: 1. How can paper be made waterproof, and yet left free from any oil, etc., which will soil or taint any article which may be wrapped in it? A. See SCIENTIFIC AMERICAN for July 12, and August 16, 1884, for receipts for waterproofing paper. 2. How may chloride of lime be solidified and moulded in stick or crayon form, and still retain its virtue and individuality, so far as its action is concerned, when used? A. Chloride of lime or bleaching powder does not come solidified, but as a powder. Chloride of calcium, the chemical salt, may be obtained by evaporating a solution of calcium chloride (made by the action of hydrochloric acid on lime or the carbonate) and heating to 200° C., when the hydrated chloride parts with all of its water, leaving the anhydrous chloride in the form of a white porous mass.

(70) R. von L. desires a receipt to give a belt a nice, dark, shining appearance. A. We would recommend you to try the following: Put a half pound shellac broken up in small pieces into a quart bottle or jug, cover it with alcohol, cork it tight, and put it on the shelf in a warm place; shake it well several times a day, then add a piece of camphor as large as a hen's egg, shake it well, and in a few hours shake it again and add one ounce lampblack. If the alcohol is good, it will all be dissolved in two days; then shake and use. If the materials were of the proper kind, the polish correctly prepared, it will dry in about five minutes, giving a gloss equal to patent leather.—We are not acquainted with the composition of the "Militair Lack."

(71) N. W. asks how far an ordinary steamboat electric light can be seen in an ordinary fog. A. The distance varies very much with the character of the fog; but we believe the electric light has not been found equal to a good oil light, as the electric light in a fog becomes so much diffused.

(72) W. P. M.—The papier mache matrices for stereotyping are made by moistening several sheets of rather stout tissue paper with very thin size, and then beating or pressing these sheets down upon the face of the type. The paper is kept in contact with the face of the type under pressure while the matrix is dried on a steam heated table.

(73) F. E. R. asks how many cells of the Bunsen battery would produce an electric light equal to 4 or 5 ordinary kerosene lamps, and if it would be practicable. A. Probably 16 or 18 cells would do it. The battery would be troublesome, and the light would cost more than kerosene if produced in that way.

(74) K. B.—You may japan small articles by dipping in japan thinned with turpentine, and baking in an oven at 250° to 270° Fah. Air drying japan is very poor in quality and hardness. You can make a black varnish with shellac, alcohol, and lampblack that will dry quickly in the air, but it will not be bright like japan.

(75) J. M. W.—We do not see how any one can protest against the use of glycerine in any form whatever, for roller composition. The formula you ask of a well known manufacturer is a secret known to them only, and as far as we can judge the following will be near to it, or will at all events make a good glycerine roller for winter: 1 pound of glue "Cooper," 2 pounds of best glycerine (white), ½ to 1 pound sugar, and 5 ounces castor oil.

(76) C. E. M. asks for a cement to stick white metal tops on glass bottles. A. One of the best cap cements consists of:

Resin....................................5 oz.
Beeswax.......................................1 oz.
Red ocher or Venetian red in powder.. .. 1 oz.

Dry the earth thoroughly on a stove at a temperature above 212° Fah. Melt the wax and resin together, and stir in the powder by degrees. Stir until cold, lest the earthy matter settle to the bottom.

(77) E. H. asks: Would a powerful jet of water directed to right or left of stern have any perceptible effect in steering the Alaska or any other ship which has lost its rudder? A. Vessels have been steered by this method, but it is not economically available.

(78) C. D. writes: I am attempting to make a tubular boiler to furnish steam for a small engine which is intended to supply power for a jeweler's lathe. 1. How many half inch tubes would be needed? A. 30 ½ inch tubes, or 12 1 inch tubes. 2. In what manner can the tubes be fastened in the top and bottom of the boiler, so that it will be steam tight? A. Expand them in the same manner as in larger boilers. There are no tubes made of iron that are suitable for expanding. You can obtain 1 inch tubes that are lap welded, that will stand expanding. 3. What pressure would a boiler of the above mentioned description, made of copper plates one-sixteenth inch thickness, safely bear? A. If you make the boiler of one-sixteenth copper, the tubes should also be of one-sixteenth copper, and brazed as well as expanded in heads one-eighth thick; rivets should be three-quarter inch apart, and seam brazed. If the whole is thoroughly brazed, the boiler will be safe at 40 pounds pressure. 4. I should like to use kerosene for fuel; in what way could it be used? A. For the methods of burning kerosene or petroleum under boilers, see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 3 and 403. Kerosene as ordinarily used we do not recommend; it is dangerous unless arranged with great care to prevent overheating.

(79) W. G. F.—All solid substances like metals that are heavier than water sink immediately to the bottom of the sea. Other materials become water logged, and sink to considerable depths, when they may not go directly to the bottom. For description of various sounding apparatus, see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 398, 433, 103, 239.

(80) F. S. asks: 1. Which will be the most durable—a flat spring 15 inches long, 2 inches wide, ¼ inch thick, fastened at one end with two bolts; the other end to move 2½ inches, or a spiral spring No. 8 wire 1¼ diameter, 8 inches long, coils ¼ inch apart, to close 2½ inch bolt, springs to be under pressure 8 or 10 hours at a time. A. The spiral spring will be the most durable and elastic. 2. We have an upright tubular boiler, about 6 horse power, which is fed by a force pump with cold water; when the water gets low with a steam pressure of 60 or 70 pounds, and the pump is started, it will keep the same pressure until you stop the pump, then it will drop 10 or 15 pounds in 5 minutes. What is the cause of it? A. It may take several minutes for the cold water to get into circulation so as to affect the upper portion where the steam is being liberated. It is very common for boilers to drop the pressure after the pump has been run with cold water feed. The cold water at first hangs to the bottom of the boiler, and does not at once begin to circulate to cool the steam generating surface.

(81) W. asks: 1. What are diamond dyes and paints made of? A. Probably solutions of the aniline colors. 2. What are the ingredients of soapine and pearline? A. We presume that they consist of partly effloresced sal soda mixed with half its weight of soda ash. Some makers add a little yellow soap, coarsely powdered, to disguise the appearance, and others a little carbonate of ammonium or borax. 3. Recipe for a good condition powder. A. Ground ginger 1 pound, antimony sulphide 1 pound, powdered sulphur 1 pound, saltpeter. Mix altogether and administer in a mash, in such quantities as may be required. 4. Recipe to make violet ink. A. Ordinary aniline violet soluble in water, with a little alcohol and glycerine, makes an excellent ink. 5. Recipe to make good shaving soap. A. Either 66 pounds tallow and 34 pounds cocoanut oil, or 33 pounds of tallow and the same quantity of palm oil and 34 pounds cocoa nut oil, treated by the cold process with 120 pounds caustic soda lye of 27° Baume, will make 214 pounds of shaving soap.

(82) W. W. P. asks: 1. What size upright boiler would freely furnish steam at 100 pounds pressure to two equalizing cylinders 2 inches by 4 inches? A. Boiler 20 inches diameter 40 inches high, 25 tubes 1¼ inches. Use petroleum. 2. What is the lightest, steel or copper boiler? And how much oil and water would it take to run with this power 25 miles over any ordinary road? A. Steel is the lightest. About 25 gallons water, 3 to 4 gallons petroleum.

(83) A. E. M. writes: I am anxious to mould some small ornamental objects in nickel and copper. I can make a splendid mould of plaster of Paris, but the great heat of the melted copper next the article seems to completely rot or decompose the plaster mould, and is not satisfactory. Can I use plumbago, or what would be best? A. A plaster mould stands better if some coal ashes are mixed with the plaster. We hardly think, however, that it will answer for an alloy that melts at so high a temperature. Graphite is made into leads for pencils and into crucibles by mixing it with clay and baking it. It probably will not answer your purpose. It is possible that a dry sand mould, made of suitable proportions of clay and loam, might answer.

(84) W. H. S. asks (1) how much the photo exposure should be decreased on a clear day, with fresh fall of snow on the ground. A. About one-third. 2. What will remove discoloration from a marble mantel due from hard coal smoke gathering on it for several years? A. To clean marble, mix quicklime with strong lye, so as to form a mixture having the consistency of cream, and apply it immediately with a brush. If this composition be allowed to remain for a day or two and be then washed off with soap and water, the marble will appear as though it were new.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

March 24, 1885,

AND EACH BEARING THAT DATE.

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

Acid, purifying sulphuric, Thomson & Kemp...... 314,548
Air compressing engine, R. P. Bolton.............. 314,218
Alarm. See Burglar alarm.
Anchor, land, G. H. Cook.............................. 314,367
Animal power, Thompson & Kucher.................. 314,492
Animal trap, J. Schaffer.............................. 314,301
Animals' mouths, device for opening, J. A. Green.. 314,527
Anvil, D. E. McCarthy................................. 314,390
Armor for vessels, forts, etc., W. N. Le Page...... 314,456
Axle box, car, S. Wills................................. 314,408
Bag, pocketbook, or purse frame, L. B. Prahar.... 314,345
Baling press bale ejector, J. L. Duval.............. 314,523
Banjo, J. B. Howe.. 314,295
Bearing for shafting, Powers & Ball................ 314,475
Bed bottom, spring, C. Carleton..................... 314,427
Bicycle, C. Johnston.................................... 314,335
Binder, temporary, A. T. Atherton.................. 314,508
Blind slats, machine for inserting pins in, G. W. Morstatt.. 314,464
Block. See Heeling block.
Boiler. See Steam boiler.
Boiler, W. H. Payne.................................... 314,467
Boiler cleaner, G. A. Galloway...................... 314,326
Boiler cleaner and filter, J. G. Miner.............. 314,257
Boiler furnace, C. Loetscher......................... 314,537
Book holder, H. Crocker....................314,436, 314,437
Boot or shoe, A. Seaver............................... 314,302
Boots, drying rubber, R. Meredith.................. 314,460
Bottle filling machine, H. Will...................... 314,280
Bottles, combined metallic cap and fastener for, A, L. Bernardin..........................314,358, 314,359
Bouquet holder, M. L. Cardell........................ 314,425
Box. See Embroidery show box.
Brake. See Car brake.
Brake lever, A. W. Hamaker......................... 314,331
Brick hack covering, J. S. Lester.................... 314,457
Brick machine, A. J. Miller........................... 314,340
Bricks, machine for the manufacture of, J. Tiffany.. 314,274
Bridge truss, G. H. Pegram........................... 314,261
Buckle, C. Kahlhofer.................................. 314,452
Burglar alarm, A. Jacobi............................. 314,450
Burner. See Gas burner. Vapor burner.
Button fastening strip, E. Woodward.............. 314,553
Camera. See Photographic camera.
Can filling machine, W. H. H. Stevenson.......... 314,352
Cans, screw cap for metal, A. F. Cooper........... 314,227
Candle machine, G. Roth.............................. 314,347
Candy machine, W. E. Henry........................ 314,529
Cannon, pneumatic, D. M. Mefford.................. 314,298
Canvas and other fabrics, machine for testing, J. F. O'Connor.................................... 314,465
Car brake, J. R. Barker............................... 314,417
Car brake, L. Brauer................................... 314,422
Car brake, I. H. Congdon............................. 314,225
Car coupling, C. M. Bennett......................... 314,421
Car coupling, H. W. Tilton........................... 314,275
Car coupling, A. W. Van Dorston.................... 314,496
Car coupling, F. Vaughan............................ 314,406
Car spring, J. T. Herschell........................... 314,245
Car starter, F., Sr., & F. Dawson, Jr............... 314,519
Car starter, N. J. Roberts............................ 314,299
Carriage, child's, E. A. & E. W. Gerbracht, 314,327, 314,328
Carrier. See Cash and parcel carrier.
Cash and parcel carrier, J. C. Martin.............. 314,339
Cash carrying apparatus, D. H. Rice........314,2 3, 314,264
Casting car axle boxes, I. H. Congdon.............. 314,226
Caustic holder, H. Bell................................ 314,420
Chimney and ventilator, combined, T. C. Harry... 314,238
Chimney, ventilating, S. T. Atkin.................. 314,309
Churn, W. Siar.. 314,399
Churn, Wilson & Sanders............................ 314,501
Churn dasher, R. W. Fisk............................ 314,322
Clamp. See Felly clamp.
Clasp. See Corset clasp. Garment clasp.
Clasp, G. A. Colton.................................... 314,366
Cleaner. See Boiler cleaner.
Clevis, A. D. Forbes................................... 314,443
Clothes drier, J. Dennis............................... 314,231
Clothes pounder, J. Just.............................. 314,534
Coal scuttle, J. Kingsley.............................. 314,454
Coffin, G. B. Markle, Jr............................... 314,538
Coin counter and tester, W. W. Haas............... 314,330
Coke from ovens, apparatus for removing, G. W. Bierer... 314,510
Combing machine roller stand, J. H. Whitehead.. 314,406
Concrete structures, mould or cribbing for, E. L. Ransome... 314,398
Converter, J. F. Wilcox............................... 314,551
Corset clasp, G. H. Colley............................ 314,434
Corset steel fastening, L. Hill....................... 314,530
Cover, culinary, G. H. Henkel........................ 314,244

Coupling. See Car coupling. Thill coupling.
Cup. See Oil cup.
Cutter. See Feed cutter. Shoe nail cutter. Thread cutter.
Depurator, J. Ketchum, Jr. 314,453
Distillation of hydrocarbons, apparatus for the, R. Dean 314,368
Doors, apparatus for operating warehouse G. L. Brownell 314,219
Draught equalizer, M. A. Davidson 314,319
Draughtsman's tool, T. G. R. Christian 314,316
Drier. See Clothes drier.
Drier, T. S. Wiles 314,500
Drill. See Ratchet drill.
Dust separating machine, P. Van Gelder 314,498
Ejector, hydraulic, Gorringe & Tengvall 314,237
Electric machines, armature for dynamo, C. L. Healy 314,242
Electric signaling apparatus, F. B. Herzog 314,292
Electric signaling circuit, T. D. Lockwood 314,386
Embroidery show box, M. H. Pulaski 314,542
End gate, wagon, G. H. Williams 314,407
Engine. See Air compressing engine. Gas engine. Rotary engine. Traction engine.
Fabrics, manufacturing illuminated, R. K. Slaughter 314,349
Feed cutter, E. F. Sherman 314,266
Feed rack, M. Thomas 314,273
Feed water heater, G. H. Babcock 314,415
Feed water heater for steam boilers, F. Doyle 314,521
Felly clamp, G. M. Dillard 314,232
Felt having a cross section varying in thickness throughout its width, producing, C. B. Dolge .. 314,369
Fence, F. A. Bartgis 314,419
Fence machine, wire, L. W. Fillebrown *et al* 314,442
Fence post, A. Handley 314,377
Fence post, B. B. Adams 314,303
Fence, wire, A. Clark 314,430
Fencing, barbed, F. W. Brainerd 314,512
Fiber disintegrating machine, T. A. Smith 314,268
Filter, A. N. Wilson 314,281
Firearm, magazine, R. S. Chaffee 314,363
Firearm, revolving, W. Trabue 314,494
Firearms, feeding mechanism for breech-loading, R. S. Chaffee 314,515
Fire escape, E. W. Fiegenbaum 314,287
Fire escape, E. Watts 314,355
Fluids, apparatus for propelling, H. Thiery 314,489
Frame. See Bag, pocketbook, or purse frame. Steam engine frame.
Fruit jar, M. R. Gannaway 314,289
Fruit jar fastening, wire, W. F. Hannes 314,332
Furnace. See Boiler furnace. Glass annealing and flattening furnace.
Gauge. See Lathe gauge.
Gang plank for vessels, L. F. Frazee 314,325
Garment clasp, F. Tucker 314,549
Garments, cutting and fitting, G. Frega 314,526
Gas, apparatus for manufacturing oil, B. C. Smith 314,484
Gas, apparatus for the manufacture of, Springer & Jeremy 314,400
Gas burner, A. P. Guyer 314,376
Gas machine, hydrocarbon, H. Allender 314,412
Gas engine, C. H. Andrew 314,284
Gas, manufacturing, Springer & Jeremy 314,486
Gate. See End gate.
Gear, reversing, H. H. Hudson 314,380
Gear wheel, A. Plamondon 314,472
Glass annealing and flattening furnace, H. Estep. 314,524
Governor, steam engine, A. E. Hardy 314,528
Governor, steam engine, J. W. Thompson 314,353
Grain scouring and cleaning machine, H. Dietz .. 314,439
Grate, E. Card 314,220
Grinding mill, J. A. Field 314,370
Hammer, bush, W. H. Harper 314,291
Handle. See Shawl strap handle. Trowel handle.
Harvester binder, Steward & Dixon 314,272
Harvester, cotton, R. K. Charles 314,365
Harvesters, sheaf carrier for self-binding, H. S. Chapman 314,364
Hatter's tank, C. H. Merritt 314,461
Hay and grain derrick and carrier, T. B. Elliott .. 314,321
Heater. See Feed water heater. Water heater.
Heating apparatus, S. Dobbs 314,320
Heeling block, E. B. Allen 314,411
Hobby horse, W. Spitznass 314,351
Hog cholera remedy, D. Schulte 314,545
Holder. See Book holder. Bouquet holder. Caustic holder. Lamp chimney holder. Rein holder. Sack holder.
Hose or tubing, E. D. Eames 314,440
Hydraulic engine, N. J. Tubbs 314,276
Hydrogen, manufacture of, G. E. Moore 314,342
Ice machine, J. C. Kitton 314,337
Inhaler, W. B. Spencer 314,485
Injector, J. Jenks 314,533
Injector and ejector, combined, T. J. Hart 314,446
Insecticide composition, F. M. Howard 314,531
Iron and steel, ingot, J. P. Witherow *et al* 314,505
Iron and steel, making ingot, J. P. Witherow *et al* 314,506
Iron or steel, machine for splitting bars and sheets of, C. M. Carnahan 314,221
Iron, purifying pig, J. P. Witherow 314,504
Iron, utilizing waste hoop, W. E. Harris 314,378
Jack. See Lifting jack.
Jar. See Fruit jar.
Journal bearing, P. S. Reeves 314,507
Knife, eraser, letter opener, etc., combined, W. W. Yonge 314,407
Lace pin and flower holder, combined, T. J. Wilson 314,502
Lace pin and other similar fastenings, S. Pinover 314,471
Ladder, S. Dennis 314,338
Ladder, step, D. Smart 314,267
Lamp, J. Kirby, Jr. 314,250
Lamp burner, E. F. Trent 314,554
Lamp chimney holder, J. Quimby, Jr. 314,397
Lamp, electric arc, C. M. Ball 314,418
Lamp extinguisher, A. Koegel 314,458
Lamp, railway car, J. Kirby, Jr. 314,251
Land roller, E. Horton 314,246
Lantern, Larges & Smith 314,383
Lantern, R. A. Stevenson 314,271
Lathe, E. S. Cobb 314,433
Lathe dog, H. Salomo 314,482
Lathe gauge, J. A. Rothwell 314,544
Lawn rake, L. Gibbs 314,373
Leveling instrument, E. A. Bostrom 314,511
Lifting jack, J. Barrett (r) 10,574
Lightning rod holder, S. R. Lawshe 314,385
Limb, artificial, W. Lockwood 314,458
Lock. See Nut lock. Time lock. Trunk lock.
Locking mechanism for doors, D. W. Tower 314,401
Mangle, J. J. A. Sorenson 314,269
Map exhibitor, J. A. Whipple 314,405
Mechanical motor, Emmert & Klutts 314,441
Mechanical movement for reversing motion, Perkins & Smith 314,469
Medicine, vermifuge, A. Regan 314,477
Metal cleaning composition, O. H. Mellum 314,256
Meter. See Water meter.
Mill. See Grinding mill.
Mixer. See Paint mixer.
Morse register, E. Estienne 314,525
Motor. See Mechanical motor.
Mowing machine, E. Pridmore 314,541
Nail making machine, wire, Loring & Morton 314,253
Necktie fastener, F. S. R. Prentiss 314,396
Nut bar, J. Gillespie 314,329
Nut lock, H. C. Burkhead 314,361
Oil cup, E. Best 314,360
Oil tank, C. A. Fisher 314,233
Oils, apparatus for freezing paraffine, J. Teagle .. 314,488
Oils, apparatus for refining, J. Thomas 314,490
Organ reed, M. Gally 314,234, 314,235
Paint mixer, D. J. Starrett 314,546
Paper pulp, apparatus for beating and manipulating, J. Jordan 314,248
Pen, fountain, W. W. Stewart 314,547
Photographic camera, W. Clark 314,317
Photographic paper and sensitive emulsion therefor, T. C. Roche 314,346
Piano agraffe, A. Baus 314,310
Piano music rack, J. Gramer 314,375
Pin. See Lace pin.
Pipe. See Tobacco pipe.
Plane, chamfer, J. Mander 314,338
Planter, automatic check row corn, Clark & Palmer 314,431
Planter check line anchor, corn, Clark & Palmer 314,432
Planter, corn, G. D. Haworth 314,239, 314,240
Plow, J. B. Brown 314,425
Plow, M. Call 314,362
Plow and mould board therefor, D. Harger 314,445
Plow, rotary, M. S. Niles 314,260
Pocket and cap, combined detachable, A. Heller .. 314,333
Post. See Fence post.
Power. See Animal power.
Printer's form, F. K. Tracy 314,495
Printers' leads, slugs, etc., machine for shaving, W. F. Klose 314,384
Pruning implement, C. F. Dean 314,230
Punch, draw plate, M. Roesgen 314,543
Punch, ticket, E. B. Hayes 314,241
Punching machine, T. M. Platts 314,474
Rack. See Feed rack. Piano music rack.
Railway, elevated, J. Jenkinson 314,247
Railway rails, device for securing fish plates to joints of, J. M. Burke 314,314
Railway switch, automatic, A. Wulff 314,554
Rake. See Lawn rake.
Ratchet drill, J. C. Imlay 314,449
Register. See Morse register.
Regulator. See Speed regulator.
Rein holder, J. F. A. Winkelmann 314,356
Rein holder, Q. M. Youngs 314,409
Rock drilling machine, H. F. Parsons 314,343
Rocking chair spring attachment, W. I. Bunker .. 314,513
Roll feed mechanism, intermittent, H. K. Jones .. 314,451
Roller. See Land roller.
Roller mill feeder, J. W. Wilson 314,552
Roller mill scraper, J. Warrington 314,278
Rolling mill appliance, D. H. Lentz 314,297
Roof and bridge truss, G. H. Pegram 314,262
Roofing felt, manufacture of, W. H. H. Childs 314,429
Rotary engine, J. L. Mitchell 314,389
Running gear, G. W. Shaw 314,348
Sack holder, J. W. Rush 314,300
Sash fastening, T. S. Smith 314,450
Sawmill dog, H. M. Wilcox 314,279
Sawmill roller, S. B. Pierce 314,470
Sawing machine, circular, G. M. Hinkley 314,379
Scraper, road, W. E. Jacobs 314,382
Seaming machine, E. Jordan 314,336
Seaming machine, sheet metal, C. Hoff 314,448
Seat. See Wagon seat.
Separating machine, P. Van Gelder 314,497
Sewing machine, buttonhole, J. S. Freese 314,444
Sewing machine guide, S. S. Spear 314,270
Sewing machine pitman, D. L. Keeler 314,249
Sewing machine wax thread, A. S. Richardson 314,478
Sewing machines, feeding mechanism for boot and shoe, F. Chase 314,516
Shafts, vehicle, H. F. Jackson 314,296
Shawl strap handle, F. E. Baker 314,509
Sheathing and lath, combined wooden, E. M. Byrkit 314,514
Sheet metal folding machine, W. J. Bayrer 314,511
Shoe fastening, S. Vetsburg 314,550
Shoe nail cutter, T. A. Manchester 314,255
Shutter, window, F. D. Paradise 314,393
Shutter worker, L. Tilton 314,493
Signal staff, G. F. Folsom 314,324
Signal transmission, circuit changer for latent, F. B. Herzog 314,294
Signal transmission, latent, F. B. Herzog 314,293
Siphon, A. D. Stansbury 314,487
Sled, S. Baum 314,217
Soap, Hoagland & Zipfel 314,447
Soldering machine, can, D. Klump 314,536
Soldering the seams of sheet metal cans, apparatus for automatically, Perkins & Smith 314,468
Sowing device, phosphate, E. Ruhland 314,265
Spark arrester, J. W. Maloney 314,254
Spars, re-enforcing band for, J. W. Ketcham 314,535
Speed regulator, A. R. Corson 314,228
Spring. See Car spring.
Stamp, hand, E. D. Chamberlain 314,315
Steam boiler, H. F. Allen 314,308
Steam boiler, G. H. Babcock 314,416
Steam by electricity, generating, Vaughan & Eldridge 314,277
Steam engine frame, A. L. Ide 314,381
Steam engines, apparatus for stopping, H. Oelert. 314,466
Step, door and terrace, E. N. & W. J. Gilfillan 314,374
Stereotype plates, machine for shaving curved, A. D. McLean 314,391
Stone lifter, T. Heathcote 314,243
Stoneworker's lathe, J. O. Messerly 314,462
Stove, J. B. Crocker 314,286
Stovepipe attachment, C. W. McCutchen 314,259
Stovepipe heating attachment, J. H. Broadus 314,423
Stovepipe shelf and drum, J. Allingham 314,413
Stoves, combined steeper and heat distributer for oil, B. Hunt 314,334
Tank. See Hatter's tank. Oil tank.
Telephone, H. Alabaster *et al* 314,304
Telephone, F. Blake 314,312
Telephone receiver, Alabaster & Gatehouse 314,306
Telephone receivers, adjustable support for, J. M. Fitch 314,371
Telephonic communication, circuit for, Alabaster & Gatehouse 314,305
Telephonic transmitter, Alabaster & Gatehouse .. 314,307
Thill coupling, G. W. Beaver 314,357
Thill coupling, J. M. Miller 314,463
Thread cutter and holder, combined, J. L. C. Cronyn 314,518
Time lock, J. B. Young 314,282, 314,283
Tire heating device, S. Mansfield 314,388
Tobacco moistening device, C. H. Clark 314,223
Tobacco packing machine, W. R. Musser 314,539
Tobacco pipe, J. Pfeiffer 314,344
Traction engine, R. S. Angell 314,285
Tricycle, H. J. Gormley 314,236
Tricycle, C. G. E. Hennig (r) 10,575
Trowel handle, C. Richardson 314,479
Truck car, I. H. Congdon 314,224
Truck, car, H. C. McCarty 314,459
Truck, car, J. D. Trammell 314,402
Trunk lock, L. E. Dupont 314,522
Truss, A. D. Winters 314,503
Umbrella notch and runner, J. G. Powell 314,394
Umbrella notches and runners, mould for, J. G. Powell 314,395
Umbrella support, F. Haitz 314,290
Valve, balanced slide, J. G. Miner 314,258
Valve, check, W. Barker 314,216
Valve, reversing, E. I. Moore 314,341
Vapor burner, J. B. Wallace 314,404
Vehicle body and seat, D. A. Vanhorne 314,499
Vehicle running gear, A. K. Caverly 314,222
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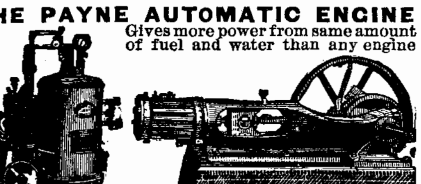

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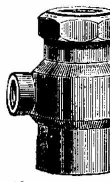

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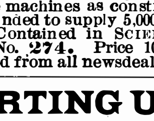

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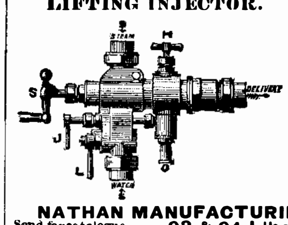

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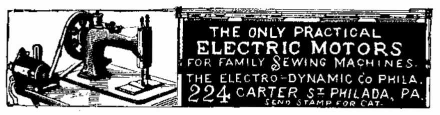

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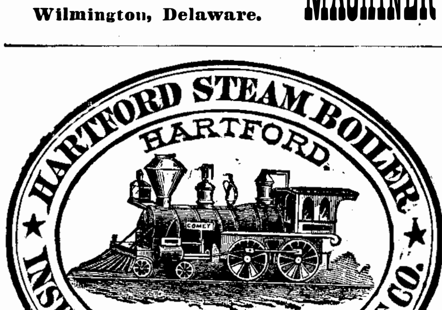

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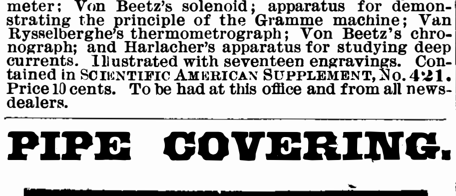

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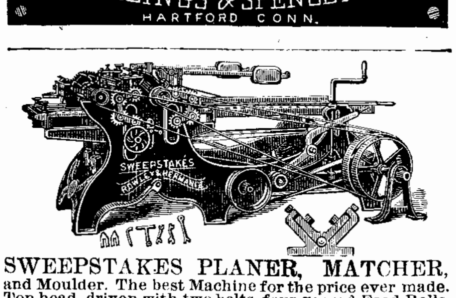

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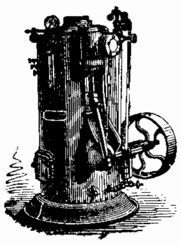

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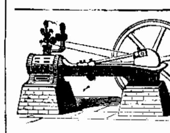

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