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# SCIENTIFIC AMERICAN

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## THOMAS HENRY HUXLEY.

We publish this week a spirited and excellent likeness of the eminent naturalist, Thomas Henry Huxley, F.R.S., LL.D.

Professor Huxley was born in the year 1825. Many writers, no doubt, looking at the enormous amount of work he has done, have *inferred* his age to be much greater, but we have our information from an intimate personal friend, and cannot be mistaken. He studied medicine, and entered the naval service as surgeon, and accompanied Captain Stanley's expedition to the Eastern Archipelago, and during the voyage made observations on the natural history of the sea, devoting especial attention to the medusæ.

On his return to England he was appointed to succeed Dr. Edward Forbes, as Professor of Paleontology at the Government School of Mines, in London; he has also been Professor of Anatomy in the Royal School of Surgery, and of Physiology in the Royal Institution of Great Britain.

Our distinguished American author, Dr. E. L. Youmans, defines Professor Huxley's position in the world of science as that of "a philosophical biologist," and as such he ranks among the very first in England or in the world. Although Dr. Huxley is profoundly learned in natural history, he has also found time for general literary culture, and is fond of poetry, fiction, and fine writing. It is this wide culture that gives him such power in his controversial writings. He seems to like nothing better than a regular set-to with some members of the old-school scientists, and he has sometimes been accused of exhibiting a pugnacious and acrimonious spirit. At one of the meetings of the British Association he had a famous tilt with Professor Owen, and on another occasion Samuel Wilberforce, Bishop of Oxford, blandly asked him in the presence of a large audience: "Is the learned gentleman really willing to have it go forth to the world that he believes himself to be descended from a monkey?" Professor Huxley rose and replied in his quiet manner, "It seems to me that the learned bishop hardly appreciates our position and duty as men of science. We are not here to inquire what we would prefer, but what is true. The progress of science from the beginning has been a conflict with old prejudices. The true origin of man is not a question of likes or dislikes, to be settled by consulting the feelings, but it is a question of evidence, to be settled by strict scientific investigation. But, as the learned bishop is curious to know my state of feeling upon the subject, I have no hesitation in saying that, were it a matter of choice with me (which clearly it is not) whether I should be descended from a respectable monkey, or from a bishop of the English church, who can put his brains to no better use than to ridicule science and misrepresent its cultivators, *I would certainly choose the monkey!*" The reply was received with a storm of applause, and Huxley was afterwards known as "the man who had extinguished 'Soapy Sam,'" as the English sometimes irreverently called the Bishop of Oxford.

Professor Huxley is a very industrious man. In addition to the writing of valuable books, such as "Man's place in Nature," "The Origin of Species," and the like, he delivers

elaborate lectures to the students of the School of Mines, and special courses of evening lectures for working men. Some of his popular lectures have been published under the title of "Lay Sermons, Addresses, and Reviews," and they are models of what such discourses should be—clear, concise, and scientifically accurate.

Professor Huxley is married to an accomplished woman, whom he met on one of his journeys to Australia. Around his own hearth and in the bosom of his family he is said to be full of humor and cheerful fun. His little boy remarked one day in the presence of a visitor who was staying with the family, "I always know when papa is chaffing by the curl of his nose."

Mrs. Huxley is musical and translates German fairy tales for her children, of whom there are seven, and Professor Huxley amuses the home circle by reading something from Wendell Holmes' poems, of whose works he is very fond, or by relating droll stories. A happier domestic circle could not easily be found.

It is to be hoped that the learned Professor will some day visit this country, and afford us an opportunity of hearing him lecture upon the value of scientific education, and upon other topics around which he has thrown such a charm by the elegance of his language, and the accuracy of his knowledge.

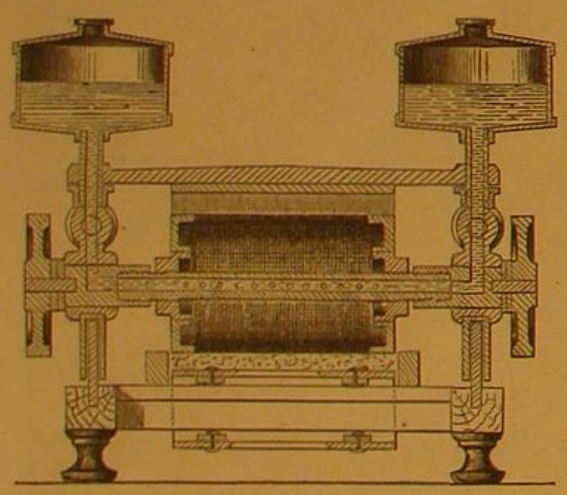
## MACHINE FOR OILING WOOL.

The object of this invention, illustrated herewith, is to form a self-regulating apparatus that will not only insure a perfect and uniform distribution of oil upon wool, but press it into the same, so that the wool becomes thoroughly saturated thereby, and can be used immediately.

By thus preparing the wool for instant use, an inferior quality of oil, or composition of oil and other materials, can be used to better advantage than has heretofore been possible, as there is no time for the oil to become gummy, or particles of the composition to evaporate, as has been the case where the wool was spread out and obliged to remain some time after being sprinkled, or otherwise prepared with oil. Moreover, the wool can be more easily and better carded and spun when thus freshly oiled.

The improvements heretofore made in wool-oiling machines have many of them possessed disadvantages arising from their complicated construction, the numerous parts occupying too much room, and interfering with the operative; the constant attendance required in operating them; the imperfect manner in which the oil is distributed over the wool—one portion of the wool receiving a large quantity of oil, and another little or none; and from various other causes that need not be stated further herein.

The most essential advantages of this wool-oiling apparatus are the time, labor, and expense saved by its self-regulating action; the simplicity of its construction and operation, requiring no pulleys, gearing, or complicated connection with the carding machine; regulating the flow and the equal distribution and pressure of the oil on the wool; the cleanliness with which the oil is kept, and the prevention of its congelation; the immediate use of the wool after being freshly oiled, and the better working of the same in consequence.



Attached to one end of the frame are standards. Fitted over these standards, so as to be raised or lowered thereon, are tubes attached to the bottoms of sockets, through which are made to revolve hollow plug-shafts. In the top of the circumference of the plug-shafts, in the centers of the sockets, apertures are formed to serve as cocks, so that by turning the shafts the oil or composition used is admitted to or excluded from them, according to the direction in which they are turned. Screwed into or otherwise connected with the ends of the plug-shafts opposite to those to which the wheels are attached, is a hollow shaft, having a slot or a series of apertures so formed in its circumference as to be at such an angle with the cocks, when they are opened, as to allow the oil to drip from the apertures and not to steadily flow from them. Connected with the hollow shaft by bearings and made to turn with or independently of the shaft, is a gauze cylinder. Stop-cocks operated by thumb-screws—which also operate indicators attached to the opposite ends of the stop-cocks and which revolve in front of dial plates not shown—control the flow of oil from reservoirs at the tops of the standards.

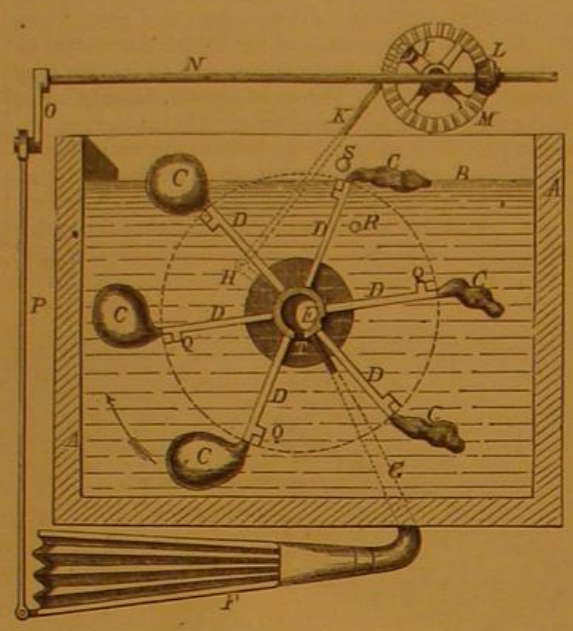
The reservoirs being filled with oil, or other material used in preparing wool, the oil, etc., is forced by the pressure of its own weight down through the tubes, the flow therein being regulated by the stop-cocks, so that a large or small quantity of oil can be admitted. The plug-shafts are turned in proper position by means of the wheels attached, which are connected with the main belt of the carding machine. The oil flows from the tubes through the apertures or cocks into the hollow shaft, from which it is distributed through the slot or apertures formed in the circumference thereof, upon the inside of the perforated or gauze cylinder, which is made to revolve around the shaft by the wool pressing against it as it is fed along by the feeding-apron. The distributing-shaft is so arranged in regard to the cocks that, when the cocks are opened, the apertures are placed at such an angle as to produce a regular and constant dripping of the oil upon the cylinder, and not to allow its flowing in a steady stream, which would be the case if the shaft were so operated as to bring its apertures directly on the under side thereof. The flow of the oil into the shaft is regulated, or entirely shut off therefrom, according to the extent to which the shafts are turned. This machine was patented by Miles Mayall, of Roxbury, Mass., Jan. 28, 1868.

## PERPETUAL MOTION.

NUMBER V.

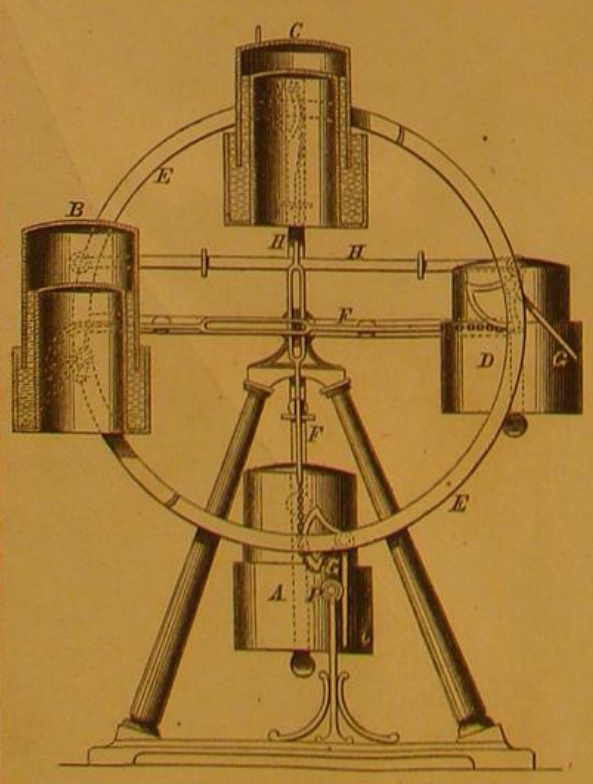
The force of gravity applied directly to the dropping arms of wheels, or to balls which roll out in troughs, fails to make such machines operate as self-movers. Inventors have sought often to utilize the buoyancy of floats in a similar way. The accompanying diagram illustrates this principle.

FIG. 11.




A is a cistern of water, filled as high as line B; C are six bladders, communicating by the tubes, D, with the hollow axle, E, which axle is connected with the bellows, F, by the pipe, G. H is a crank, connected with the crank, I, by the rod, K. L is a bevel wheel, M a pinion, N its shaft. O is a crank, attached to the bellows, F, by the rod, P. Q are valves with projecting levers. R and S are two projecting knobs. T is a hole in the axle, E, forming a communication with it and the lowermost bladder. The axle, E, being put in motion, is expected to carry round the bladders and tables, and by the cranks, H and I, and the connecting rod, K, cause the wheel, L, to revolve, which communicating a similar but accelerated motion to the pinion, M, shaft, N, and crank, O, works or blows the bellows, F, by the rod, P, from which the air enters the axle, E, by the tube, G, and passing through the hole in it at T, enters the lower bladder, C, by the tube, D; this bladder being thus rendered lighter than the space it occupies, ascends, bringing the

FIG. 12.




bladder behind it over the hole in the axle, T, in like manner, and which is thereby expected to gain an ascending power, producing a similar effect on the one behind it. When one of the bladders arrives at the knob, S, the lever of the valve, Q, strikes against it, and opens the valve when the bladder arrives at U and begins to descend, its pressure on the water drives out the air, and gives it a descending power; the knob, R, then closes the valve, Q, and prevents the entrance of any water into the bladder; by this contrivance, three of the bladders were expected to be alternately full and empty, according as they passed over the hole, T, or the knob, S.

The reason assigned for the failure of this machine was the friction, the old invincible enemy of perpetual-motion seekers.

Amid all the fruitless attempts which have appeared, there was still one avenue to the object of pursuit, to which the common and well-known principles of hydrostatics seemed to direct the way; this was the principle that any body specifically, or bulk for bulk, lighter than common air, will rise and swim in it. Consequently, if a certain quantity of vessels are attached at equal distances, round the circumference or rim of a wheel, so contrived as that one half of the vessels shall be exhausted on one side of the wheel, and the other half filled with air on the opposite side, in this case the exhausted vessels will attain the highest part of the wheel, and the full ones the lowest. But to render the matter more explicit, we must refer to the annexed engraving, Fig. 12.

A B C D are four vessels connected to the wheels, E, by round pins which project from the vessels on each side, and enter into corresponding holes in the wheels, E. The wheels, E, are intended to revolve by the space under the vessel, B, being a vacuum, and therefore lighter than the same portion of air; a little before the vessel, B, reaches the highest point of the wheels, it begins to close, and opens the opposite vessel, D, in the same manner as the vessel, C, opens A, because the pressure of the atmosphere on the vessel, C, is equal to the pressure on A. Instead of common packing to make the vessels air-tight, mercury is substituted, which has less friction, and is never out of order. The particles of mercury not being entirely free from friction, a little power is requisite to open and shut the vessels; this is expected to be effected by the rods, F, connected to the lever, G, by chains. The rods, F, give motion to other rods, H, by the rollers acting against collars on the rods, H, not shown.

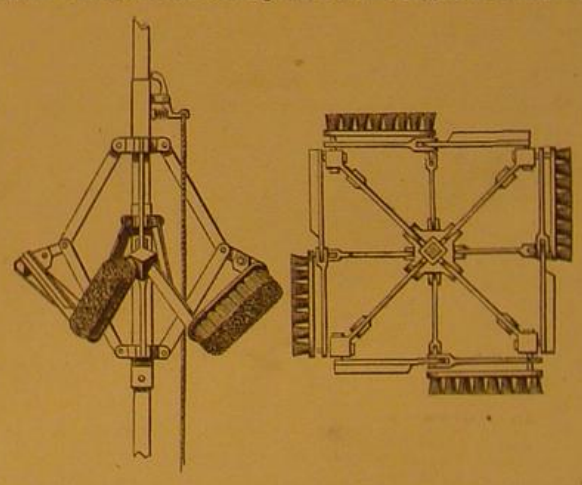
The levers, G, are successively worked by sliding over the roller, P. The connecting rods, H, are so adjusted as not to draw the vessels out of their upright position, which would let the mercury escape; also, the lower vessels, A and D, are made rather larger in diameter than B C, so that the pressure of the atmosphere may counterpoise the weight of the vessels, A C and B D, with their connecting rods.

The inventor of this contrivance says:

"I doubt not in the least, that if a pneumatic machine like this were accurately executed, it would continue in perpetual motion: yet I still think the power might be greatly increased by placing the whole engine under a receiver of condensed air, say from ten to twelve atmospheres, which would weigh, if it were ten atmospheres, about twelve ounces per cubic foot."

## IMPROVED CHIMNEY CLEANER.

Many flue-sweeping devices are not effective in clearing the angles of a square or rectangular flue, as they consist mainly



of a circular head with radial bristles of whalebone, cane, or other like material, which, if of proper diameter to operate effectively on the sides of the flue, will not reach the angles, and if of sufficient length to reach the angles, are so much curved where they come in contact with its sides as to have but little if any effect in removing the soot therefrom. To remedy these difficulties is the object of the invention illustrated by our engraving. It consists in the construction of a brush or scraper frame supported on a central shaft, the several parts of which are so hinged or jointed together as that they may be distended or contracted at pleasure to suit flues of different dimensions, or to pass readily any contractions or irregularity in the formation of such flues.

The stem or staff of the apparatus, which is constructed in sections of convenient length to be passed up the flue successively, and connected each with the preceding one by a bayonet lock or other suitable coupling. To the upper section of this staff, at a suitable distance from its top, is attached a collar, to which are jointed, at its four opposite sides, in a hinge-like manner, arms extending upwardly. Above this, on the staff, is a sliding collar, to the lower end of which are jointed, in a similar manner, arms which extend downwardly and are connected with the other set of arms, as shown. On the lower end of each of the arms is an enlargement, to which are attached bars, which form, when extended, a rectangular frame supported by arms or braces around the staff. These

bars are jointed or hinged together midway between angle blocks, at which point they are again supported by braces hinged thereto, and at their opposite ends to another sliding collar, on the staff between the fixed and sliding collars. The sliding collar carries a spring-borne pawl which locks into apertures or notches in the side of the staff, and thus secures it in any desired position thereon. To the lower end of this pawl is attached a small cord, by which it may be disengaged from the staff when passed to the requisite distance up the chimney or flue. To each of the bars forming the rectangular frame is attached, on its outermost side, a brush or scraper, whichever it may be desired to operate with.

This ingenious device is the invention of Thomas H. Donohue, Washington, D. C., and was patented by him May 6, 1868.

### Improved Gate.

Our engravings represent an improved form of gate of the class known as sliding gates, wherein, by an ingenious link motion and the use of a weighted balancing lever, the gate is made to move backwards or forwards in a nearly horizontal line without tilting and with very little friction.

The construction is simple and cheap, and the gate appears well adapted to general use.

Fig. 1 represents the gate as closed, and Fig. 2 the same as opened. A is the gate, B the panel of the fence along which the gate slides or runs in opening and closing; C and D are vertical bars attached to the gate, one at the center and the other at the rear end, rising considerably above the top of the gate, and having vertical slots, E, in the upper parts. F represents pairs of bars, nearly as long as the bars, C and D, pivoted near the ground, one pair at the front end of the panel, B, of the fence, and the other as far back as the distance between the bars, C and D, and as near the path of the gate as may be, and let it pass between the bars of each pair. These bars carry rollers on studs at G, on the side next the gate, which rollers work in the slots, E.

H represents links about half the length of the bars, F, pivoted to the bars, C and D, at the bottom, as shown, and to the bars, F, at or about the center. J represents a pair of links pivoted to the bars, F, and also to the top of the weighted lever, K, at J. The weighted lever is also pivoted at L to a fixed support rising from the ground.

The gate is thus suspended on the bars, F, and is carried past their pivot centers at the bottom of the links, H, at each opening or closing of the gate, the weighted lever preventing the bars, F, from sagging, and consequently preventing the gate from tilting endwise.

The links describe equal arcs, the curvatures of which are reversed as to each other, and hence the resultant motion of the gate is nearly in a straight horizontal line.

Patented through the Scientific American Patent Agency, December 20, 1870, by Henry R. Hoskins, whom address for further information, Harlan Allen Co., Ind.

Fig. 1

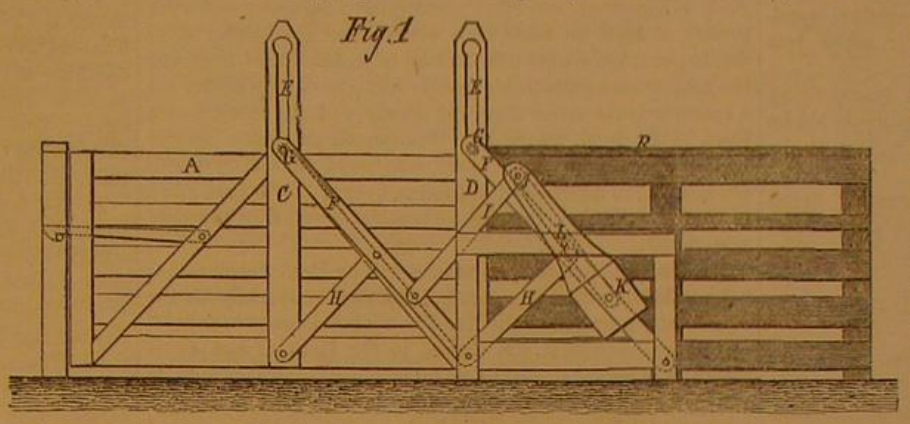
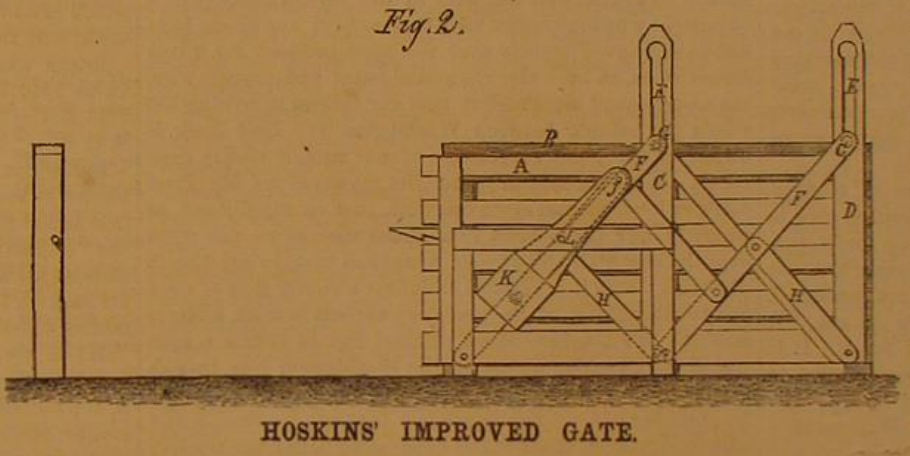



Fig. 2.




HOSKINS' IMPROVED GATE.

### Newton's Process for Duplicating Negatives.

Mr. H. J. Newton, of this city, makes known the following process through the Philadelphia *Photographer*. We have seen some magnificent specimens of transparencies. The process is evidently one of value:

"Let photographers provide themselves with one or more positives of their valuable negatives, and they are insured, to a great extent, against loss from accidents that may happen to them. The first thing to be provided with is a suitable collodio-chloride. After repeated experiments I determined upon the following formula as the best for my purpose: alcohol and ether, equal parts; chloride of magnesium, 4 grains; citric acid, 4 grains; nitrate of silver, to the ounce, 12 grains. These proportions appeared to be the best, but there was always a variation in the working of this compound, depending upon the manner of its compounding. The best results were produced in the following way:

"Dissolve in one ounce of alcohol 24 grains chloride of magnesium, then add 36 grains of intense cotton; next pulverize in a mortar 24 grains citric acid with 72 grains nitrate of silver; pulverize to an impalpable powder, and then add 2 ounces alcohol; continue to agitate until the alcohol is completely saturated; now add to the solution of chloride 3 ounces ether, shake well for two or three minutes, and pour the whole slowly into the mortar, stirring briskly while doing so. As soon as the vial is empty pour the whole back into it. It can then be filtered, and is ready for use. When prepared in this way it is much more sensitive than when prepared otherwise, and prints with a deeper and richer color, giving, therefore, stronger and more vigorous prints. The glass is coated with albumen, prepared by dissolving the white of one egg in 6 ounces of water and 10 drops of ammonia, filtered, and flowed on when the glass is wet. When thoroughly dry flow with the collodio-chloride, and dry with artificial heat. When dry set it on one side, and warm the negative to about 120°, or to about the same temperature of the prepared collodio-chloride plate; put the negative in the printing frame, and, when cooled to about 100°, or to blood heat, put the prepared plate over the negative in the printing frame, and expose to sunlight from fifteen to twenty minutes for a thin negative. By opening one half the frame and looking through, you will be able to tell, with a little experience, when it is printed deep enough. The obstacle in the way which seemed the most insurmountable was pinholes in the deep shadows. To call them pinholes gives but a faint conception of the reality; they would, in long printing, literally form a sieve. I attributed the cause to vapor confined between the two glasses; they, having been put together cold, and placed in the sunlight, became in a short time very hot. I am far from sure that such a theory is correct, but I am sure that after heating the negative as described I had much less trouble. Yet care should be taken that the negative does not get very hot in the sunlight.

"When the print has become of sufficient intensity, remove from the frame, and wash for a short time under the tap, and fix in the old hypo and gold toning bath; this bath should be made at least twenty-four hours before using, and quite weak with hypo. The older this bath is the better it works.

"If you find, on removing the print from the frame, that it is not printed deep enough, it can be strengthened with pyrogallic acid and silver, the same as a negative. This treatment with pyrogallic acid will give you a much richer tone than you would otherwise get; it will require a much longer time, however, in the fixing and toning bath, and instead of diminishing in strength, will increase in intensity. When toned to suit your taste there only remains, to complete the positive, washing and drying. To make a negative from the positive so obtained, proceed in precisely the same manner as already described for a positive. The positive should be varnished before placing it in the sunlight in contact with a prepared collodio-chloride plate, or the positive will, in a short time, almost entirely disappear. This phenomenon, to me, was most extraordinary, and I am not yet satisfied what is the exa t cause. The coat of varnish, however, was an effectual preventive, which shows that the action was one of contact between the prepared surfaces caused by the action of sunlight, or rather, incited to action by the solar rays.

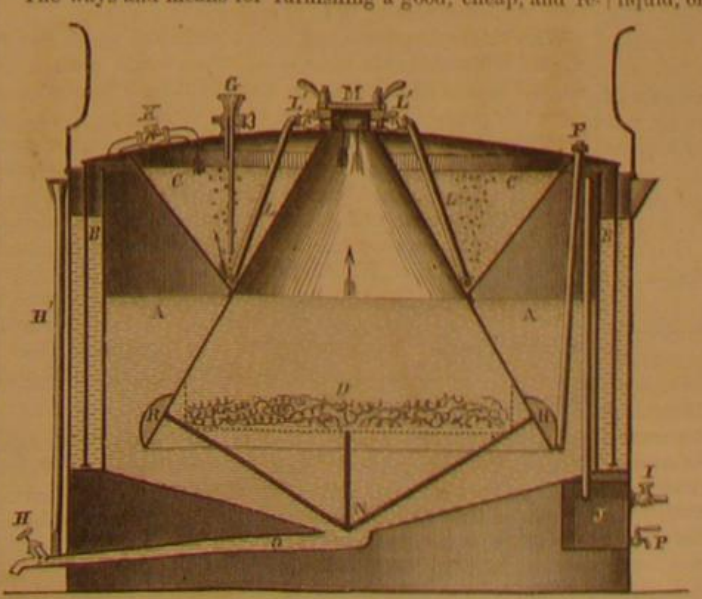
"Positives made in this way are of surpassing beauty, containing all the fine detail of the negative, soft and brilliant, and of a tone I have never seen equaled."

The best kind of printing frame for this purpose is one similar to, or the same as, those used for printing pictures on porcelain, for when using such, the printing may be watched in its progress without danger of displacing either glass.

### CARBURETED HYDROGEN GAS.

The ways and means for furnishing a good, cheap, and reliable illuminating gas, have taxed the brains of chemists greatly, and since the discovery of the petroleum wells in this country, a few years since, the subject has received a new impetus. But it has been found that the adaptation of the volatile hydrocarbon oils distilled from petroleum to use in gas apparatus, especially portable ones, presents many difficulties. Some apparatuses designed to utilize these oils for lighting purposes have met with a limited degree of success. It has been found that the vapor of the volatile oils referred to is too rich to burn unmixed with some diluent, causing the precipitation of unburnt carbon in the apartment where burned; and the very numerous devices for mixing air therewith for producing illuminating gas have so far, on account of mechanical as well as chemical reasons, failed to come up to the requirements of useful application as to be generally considered unreliable. The causes are too numerous to specify here, and are doubtless familiar to many if not most of our readers.

A trial of apparatuses and devices for generating illuminating gas in a portable manner was undertaken by the chemists of the American Institute, last fall, after the close of the exhibition, and the opinion arrived at by the judges in their report was decidedly adverse to the "carbureted air" principle, as the following quotation from their report will show: "Hydrogen gas as a basis, rendered luminous by a hydrocarbon oil, vapor, or otherwise, is the light of the immediate future for all portable gas apparatuses, and will fulfill all the requirements demanded of them by the public, viz., luminosity, safety, reliability, and economy. In points of durability and convenience it is perfectly practicable, while its safety is greater than that of kerosene oil or of air gasmachines."




The accompanying engraving shows a perpendicular sectional view of an apparatus for generating carbureted hydrogen gas, invented by C. F. Dunderdale, of this city, and covered by several patents dated from June 1, 1869. The following brief description and reference to the various parts will suffice to show its arrangement and manner of operation:

A is a mixture of water and oil of vitriol; B the water seal for floating gasometer, which, rising and falling, regulates the generation of the gas automatically; C shows the hydrocarbon liquid in its chamber; D the iron shavings resting in a wire-cloth basket, the immersion of which into the acidulated water generates the hydrogen gas. The arrows show the course of the gas as it rises from the metal turnings, down pipes, L', and bubbling up through the hydrocarbon liquid, becoming thereby carbureted, and passing through pipe and valve, K, into the holder, where it is stored until used.

The various other devices are for the efficient and simple handling and management of the apparatus when in operation.

The gas generated by this method is of high illuminating power, and, we are informed by the inventor, costs per thousand cubic feet less than gas furnished by ths gas companies and is burnt in the smallest size coal-gas burners that consume from one and a half to two cubic feet per hour, and which are claimed to give an illuminating power greater than coal gas burnt in a burner that consumes six cubic feet per hour. It is said this claim has been confirmed by photometric test. This apparatus, we are informed, received the highest and only medal, a diploma and honorable mention at the Exhibition of the American Institute, last fall, after a competitive trial of different apparatuses.

Particulars relating to this apparatus, and rights, etc., to manufacture and sell under the patents, can be had from the patentee, C. F. Dunderdale, 90 Wall street, New York.

### Sensitive Tests for Hyposulphite of Soda.

According to the *Journal fur Chemie*, the most delicate test for hyposulphite of soda is permanganate of potash. Its application is simple and easy, and well adapted, therefore, to the wants of the working photographer. One decigramme of pure permanganate of potash and one gramme of chemically pure carbonate of soda are dissolved in half a liter of water, yielding a transparent rosy-colored solution. This liquid, on coming in contact with the most minute trace of hyposulphite, loses its red color, and assumes at once a greenish hue. A finer test than this, probably does not exist.

Licht enumerates other tests for hyposulphite, which are more or less practical in their nature, but are, nevertheless, well worthy of record.

1. The test based upon the blackening of sugar of lead paper by means of hydrogen, produced by the action of pure sulphuric acid upon pure zinc, when the fluid in the gas-generating vessel contains hyposulphite of soda.

2. The galvanic test, in which pure silver foil, under the influence of an electric current, becomes of a yellow or brownish color in the presence of hyposulphite of soda.

3. Grune's test, where a collodion film, rendered of a whitish color by the application of chloride of mercury, fulfills the duty of reagent, and assumes a grayish tone when affected by hyposulphite of soda.

4. The very precise test afforded by the use of blue iodide of starch, which bleaches readily when hyposulphite in minute quantity is mixed therewith. It is probably only the first and last of these tests that will be found practical in photographic operations; they are

both very trustworthy ones, and require but little knowledge or skill in their application.

## Correspondence.

*The Editors are not responsible for the opinions expressed by their Correspondents.*

### Wickham's Perpetual Motion Patent.

MESSRS. EDITORS:—I have noticed in the SCIENTIFIC AMERICAN of the 17th December, an article headed "Perpetual Motion," in which it speaks, on page 386, of a perpetual motion machine invented by Horace Wickham, Jr., of Chicago, and on which a patent was obtained July 26th, 1870.

As this statement may mislead the public as to the nature of the patent granted, I deem it proper to state that no patent was issued for a perpetual motion.

Letters patent No. 105,870, 26th July, 1870, were issued to Horace Wickham, Jr., for an "Improvement in Motive Power," in which the specification states, under the head of "Nature and object of my invention: "My invention relates to a machine for transmitting motion," etc. The original specification was for a self-sustaining motive power, which was rejected.

The patent was granted for a machine for transmitting motion. It possessed novelty, since no reference could be found anticipating the devices. It possessed utility, as defined in paragraph 449; Curtis on Patents.

By applying any power at either end or alternately to the ends of the rocking beam, it may serve the purpose of transmitting motion to the operative devices and thence to the material to be acted upon.

The letter of the first rejection, dated July 11, 1870, was as follows:

"The application above referred to has been examined. The applicant claims a "self-sustaining motive power;" in other words, a machine that renews its motive power from itself without the intervention of external causes. It is admitted by all the authorities on mechanics that the various resistances to motion, viz.: friction, gravity stiffness of machinery, etc., necessarily retard, and finally stop the machine. Now, a machine is a simple or complex structure of inanimate material, and inanimate bodies cannot give themselves motion, nor can they change the motion they may have received.

"But the applicant's invention is stated to be a 'self-sustaining motive power,' that is, this machine is said to give to itself renewed motive power in order to make up for its constant loss of power due to the various resistances which are constantly retarding its movement. As this cannot be effected, the machine is not a self-sustaining motive power. It must stop. It will not effect the result claimed for it. It is then deficient in result, and must be rejected as deficient in this essential quality of patentable invention."

Washington, D. C. J. W. ABERT.

### Automatic Telegraphy.

MESSRS. EDITORS:—In your issue of December 17th, is a reply (by that eminent electrician, Moses G. Farmer, Esq., of Boston) to an article upon the subject of "Automatic Telegraphy," by George B. Prescott, Esq., the talented electrician of the Western Union Telegraph Company.

With your permission, I would like to call the learned Professor's attention to an inadvertant omission on his part, of a fact now well known to experts in the exact science of telegraphy, namely: it being possible under certain conditions to transmit telegrams over a line composed of No. 8 iron wire, 250 miles long, at almost any rate of speed up to 2,000 or more words per minute.

Yet, notwithstanding the fact here stated, I should, under all circumstances, prefer and also recommend the use of the (to me) beautiful compound wire, composed of steel and copper, on account of its superior strength and great conductivity, requiring at the same time only one half the number of poles per mile; and requiring also a less amount of electro-motive force to operate the machinery used in connection therewith.

Rutherford Park, N. J. GEORGE LITTLE.

### Effect of Explosions on Weather.—The Nitro-Glycerin Explosion at Fairport, Ohio.

MESSRS. EDITORS:—I notice an inquiry in your last issue concerning rain after the Fairport nitro-glycerin explosion. I was at Canfield, Ohio, during the week in which it occurred. The explosion occurring on Tuesday evening was followed on Friday night by a rain beginning at 9·30 P.M.; amount of rain, 0·42 inches. The weather for the week preceding was unusually fine, and on Saturday at 11·30 A. M., the sky became clear, and remained so for several days. Wind at time of rain, N.N.E. The rain was not preceded by the usual rise in the dew point of the air; barometer fell suddenly, and as quickly rose again to its normal hight. These are the facts relative to the only rain which followed the explosion for some ten days.

W. R. SMILEY, Observor for Smithsonian Institute.

New Lisbon, Ohio.

WE regret to learn from *Nature* that Sir R. I. Murchison has been stricken with an attack of paralysis; at last accounts he had somewhat improved, but in a disease of this character we fear the attack is the beginning of the end. The same journal also announces that Professor Balfour Stewart, the eminent physicist of Owen's College, Manchester, was among the sufferers by the recent collision on the London and Northwestern Railway—one thigh was broken and a terrible shock given to the nervous system. He is doing as well as could be expected under the circumstances.

[For the Scientific American.]

## AUTOMATIC TELEGRAPHY.

BY D. H. CRAIG.

I have read with attention the speculations of Professor Farmer and Mr. Prescott, in recent numbers of the SCIENTIFIC AMERICAN, upon the subject of automatic or "fast" telegraphy, but regarding the conclusions of those gentlemen in the light of our practical experience, during the past two years, I cannot help saying, with all respect for their distinguished reputations, that they appear to me very blind and unreliable teachers.

It is undoubtedly true that Mr. Little and his friends have not a particle of "science" (as electricity is taught in the books, or as it has been taught by those who have assumed to be its exponents, in a practical way) to stand upon, when they claim to telegraph over long lines one thousand words per minute! and yet they know this rate of speed is entirely practicable, and is thus even more easily and satisfactorily accomplished than it can be on a short line.

All who have preceded Mr. Little (including Prof. Farmer, Prof. Wheatstone, and Mr. Prescott) have assumed, and even proven, at least to their own satisfaction, that about sixty words per minute over a No. 9 iron wire, 250 miles long, was the maximum of attainable speed; and I have now before me a recent private letter from the manager of the Government lines in England, where the Wheatstone automatic system has been in use for many years, who says that sixty words per minute, in a circuit of 200 miles, over a No. 6 iron wire, is there regarded as the highest attainable speed of practical telegraphy.

Mr. Prescott's statement, assented to by Prof. Farmer, that "the speed of automatic transmission varies inversely as the square of the length of the line," is, doubtless, good "science," as they understand it, but viewed in the light of our experience, it is arrant nonsense, as all our tests go unerringly to prove that with the Little system of automatic or "fast" telegraphy, *the longer the circuit, the better the work*, provided always, of course, that the wire in use carries a steady flow of current when in contact with the battery; and as we have had equally good results over the most ordinary No. 9 iron Morse wires, as over the compound (steel and copper) wire, the assertions of Mr. Prescott that our success in writing 250 words per minute between Washington and New York, is owing to the great superiority of our wire, is wholly erroneous. With our system (which, let me say is *not* Mr. Prescott's or Prof. Farmer's) we can work just as rapidly and as correctly over the poorest iron Morse wire, as we can work over the best steel and copper compound wire, in any length of circuit where it is possible to deliver a steady flow of even one twentieth part of the necessary current to work a Morse machine or a Hughes-Phelps printer! but of course a compound wire, such as we use on the Washington line, though it adds nothing to the average cost of lines, considering the less number of posts and insulators that are required, really adds nearly three times to the conducting power and tensible strength as compared with the iron wire in general use by the Morse lines. While, therefore, our wire would enable us to telegraph over a circuit two or three times greater than we could do with a common iron Morse wire, the latter would answer our purpose precisely as well as the former in any length of circuit where the iron wire could deliver a steady flow (however slight) of current.

The difficulty with Mr. Prescott and all other parties who have striven so vigorously to write down automatic telegraphy, is, that through ignorance or design, they have utterly ignored the important fact that Mr. Little uses electricity under entirely different conditions from what it was ever before used by any person who has experimented in fast telegraphy; and it is to this fact, and not at all to the fact that we have a superior line that we transmit and record correctly 1,000 words per minute, or 60,000 words per hour, over a single wire, equal to the average speed of 100 wires by the Morse system.

Prof. Farmer's suggestions to me to print instead of writing our messages with a pen, was successfully and advantageously practiced by the old American Telegraph Co. as long ago as 1856, and we have, so far, improved upon that idea as to have devised a printer which is worked with keys, and prints in note form, and in plain Roman characters, at the rate of three to four thousand words per hour, and manifolds at pleasure, from 10 to 20 copies at one writing.

With this rapid printer, and with a perforator which may be worked with nearly the same speed, there would seem to be no good reason why the public should not have 20-word messages telegraphed from one end of the country to the other, for ten cents each, provided they will furnish enough of such messages to keep one or two wires constantly employed, ten hours per day, between leading cities of the Union.

The Little system of fast telegraphy, having been satisfactorily tested, in an experimental way, is now about be placed before the public of Washington and New York and intermediate cities for the transaction of public business, and it is not doubted by any one who understands the principles which govern the new system, that it is destined to effect a complete revolution in the whole telegraph and postal business of the country.

VOCALISES.—We are indebted to the author, Miss Anna Ballard, the accomplished teacher of vocal music at Vassar College, for a series of musical exercises for the voice having the above title. These exercises appear to be well adapted for the development and cultivation of the vocal organs, giving facility of execution and equality of delivery. The system here presented has been adopted at Vassar College with the most gratifying practical results. Published by Oliver Ditson, New York and Boston.

### The Antiquity of Invention.

The most ancient invention is that of the needle; whether the credit of this invention is due to Adam or to Eve, we know not, but we do know that the Bible says "they sewed fig leaves together and made themselves aprons." To sew without a needle would be an impossibility, therefore they must have invented one; whether from a thorn, shay stick, or fish-bone, is also a matter of doubt. How ancient, then, is the trade of dressmaking; and when we look at the fashionably dressed woman of to-day and reflect that all her dress, finery, etc., is the result of the combined thought, industry, and perseverance of dress-makers for nearly 6,000 years, is it to be wondered at that she is "fearfully and wonderfully made?"

To Noah is attributed the invention of wine, 2347 B. C. Ale was known at least 404 B. C., and beer is mentioned by Xenophon 401 B. C. Backgammon, the most ancient of our games, was invented by Palamedes, of Greece, 1224 B. C. Chess is of later date, and originated 680 years before the Christian Era. The first circus was built by Tarquin, 605 B. C., and theatrical representations took place as long ago as 562 B. C.; the first tragedy represented was written by Thespis, 536 B. C. So it seems that the ancients were not as destitute of amusements as one would suppose. Is it not possible that the great philosopher, Socrates, delighted in chess; that Sophocles amused his little friends by taking them to see the gladiators and the tragedians, and that even immortal Homer could play a fair game of backgammon?

As for musical instruments, they possessed the psaltry, harp, lute, and that most ancient instrument, the cymbal, which is spoken of as long ago as 1580 B. C. The flute was the invention of Hyaginus, 1506 B. C.; organs were invented by Archimides, 220 B. C.; and Nero played upon the melodious bagpipe 51 A. D.

In household furniture, glass was used by the Egyptians; crockery was known to the Egyptians and Greeks 1490 B. C.; carpets were in use 800 B. C.; clocks which measured time by the falling of water were invented 158 B. C.; sun-dials, which had been in use previous to the invention of the water-clock, date from 550 B. C.

Bricks were made 2247 B. C.; the lathe was invented by Talus 1240 B. C. The compass was used by the Chinese 1115 B. C. Bellows are the invention of Anarcharsis, 569 B. C.

But when we think that bread made from wheat was known to the Chinese 3860 years ago, we must confess that it is rather stale; we can imagine the young "heathen Chinee" of that date, crying lustily for bread and honey. These Chinese are a wonderful people, and no mistake, for even as far back as 1100 B. C. Mr. Pa-out-she wrote a dictionary containing 40,000 characters representing words.

When we read that the arts and sciences of astronomy, 2234 B. C.; sculpture and painting, 2100 B. C.; geometry, 2095 B. C.; husbandry, 1998 B. C.; poetry; philosophy; mathematics; mechanics; hydrostatics; geography; mensuration geology; metallurgy; chemistry, called alchemy; and surgery, were all known to the ancients, we almost exclaim with Solomon, "there is no new thing under the sun."

"WARREN."

### Chemists who have Died in 1870.

Some of the most renowned and useful chemists of Europe have passed away during the year 1870. It is well to call them once more to mind before we close the volume for the year.

Professor F. T. Otto died at Brunswick, January 13, 1870. To him we are indebted for some of our best tests for poisons and for one of the most thorough works on chemistry extant.

Professor Gustavus Henry Magnus died at Berlin, April 4, 1870. He was in early life a chemist, but of late years had devoted himself exclusively to physics.

Professor Palmstedt died in Stockholm, April 6, 1870. He was one of the benefactors of Sweden, the friend and cotemporary of Berzelius and lived to the ripe old age of 85.

Niepce de St. Victor died in Paris, April 7, 1870. To him the world owes a debt of gratitude for the brilliant discoveries made by him in photography.

Professor Alexander P. Bolley, died August 3, 1870. In the field of technology he never had a superior, and we fear it will be long before we shall find his equal.

Professor Wm. Allen Miller, died Sept. 30, 1870. The well known author of Miller's Chemistry, and one of the most zealous investigators in the department of celestial photography.

Augustus Matthiessen, died by his own hand, in October, 1870. A conscientious, sensitive worker in electricity, and the discoverer of laws of telegraphy that are of the utmost value to the world.

Thus have passed away seven of the most active workers in the field of chemistry, whose places it will be difficult to fill.

BROWN HEMATITE.—Prof. Osborn, of the Miami University, writes us as follows: "It may be interesting to state that I have lately met with large deposits of an aluminous brown hematite ore, laid down, not in beds, as this ore generally occurs, but in vast masses of horizontal layers, closely resembling a light-colored heavy shale. Outwardly none would suspect the ore, but an approximate analysis gives 37· metallic iron, with traces of phosphoric acid, considerable alumina, some silica, and lime. Large masses or hills of this ore occur in Coshocton and Licking counties, Ohio; and though formerly no notice was taken of it, many tuns have lately been used to great satisfaction in the charcoal furnaces along and not far off the line of the Pittsburgh and St. Louis (Pan Handle route.

## DR. DOREMUS ON THE TRIUMPHS OF SCIENCE.

The third lecture of the course of lectures by Dr. Doremus before the Young Men's Christian Association first recapitulated the various principles in regard to the combination of the elements explained in his last lecture. The Professor then said the metals were rarely found in a native state; they had "loves" or affinities with many other substances. As an illustration he would cite gold, silver, and iron, which were scarcely ever found pure. When iron ores were mingled with carbon and lime in a furnace, and a blast of pure air applied below, the iron associated with a little carbon, and ran out in a stream, which supplied molds made in the sand floor of the furnace, called pigs. Such iron is consequently known as pig iron. No one subject now commanded more attention from chemists than the production and manufacture of iron.

An analysis of the crust of the earth showed how largely oxygen had entered into its combination. Chemists announced that the basis of clay was a beautiful white metal called aluminum. The Professor then showed how a slight difference in the proportions in which other elements were mingled with alumina resulted in the numerous forms of clay, some of which were suited for the manufacture of the most beautiful kinds of porcelain, while others were used for making coarse tiles and pottery of all kinds. In the Bible it was stated that men were made of clay; but it might be said in passing that the metal which formed the basis of that substance was almost the only one not found by chemists in the human frame. Doubtless the Biblical reading ought to be earth.

The Professor next again returned to the discoveries brought to light by spectrum analysis. By this means several new metals had already been discovered. Then, as another proof of its value, it might be stated that metallic poisons could now be detected with sufficient precision for the purposes of a court of justice. Only a few years ago he had obtained proof of the presence of arsenic in a body after it had been interred twelve months. These modern refinements were due mainly to the spectroscope.

Sulphur in a pure and crystallized state was found at the mouth of volcanoes, and also in combination with many metals. It was very useful, especially as from it was manufactured sulphuric acid, or the king of acids. The mode of manufacturing this acid was then illustrated. Oil of vitriol applied to common salt resulted in hydrochloric acid, with a residue of soda. So important was sulphur that when the people who obtained it from volcanoes endeavored to get a higher price for their wares, no less than fifteen new patents for its manufacture were taken out. From hydrochloric acid we get chlorine, which, if mingled with coloring matter, like indigo and lime, had the power of removing the color. This discovery was one of the most important ever discovered. Chlorine was also the most powerful disinfectant known. A few years ago a cabin in one of the Cunard steamers, which had been infected with small-pox, had been effectually cleansed by this wonderful gas. It was a rather shameful fact that nearly all the caustic soda now used in this country was imported, a fact which showed the necessity, among other things, of providing higher means of scientific education among us. Sulphur also combined with India-rubber, and formed a singularly beautiful substance, out of which the well-known India-rubber trotting wagon was made. He believed this substance would at no distant date be employed more generally than at present.

The Professor then alluded to M. Tessier's method of obtaining oxygen gas—a method involving scarcely any expense. This was of the last importance, as oxygen was the essential element of heat and life. He then referred to the production of phosphorus, which was now procured from bones. Compounds of phosphorus were especially important to the human system as they seemed essential to intellectual effort. Butter, among other articles, contained a palpable quantity of this important substance.

Probably the sun produced its heat by chemical combustion. Some physicists maintained that a slight condensation of its surface would enable it to maintain this heat-giving power for thousands and millions of years, and others believed that the loss it thus sustained was made up by the occasional attraction of foreign bodies. Attempts have been made to find out the quantity of heat thrown out by the sun, and it had been calculated that our earth absorbed only the three hundred thousand millionth part of the total amount. As our earth is but a rusted mass of molten metal, so, perhaps, is the sun undergoing the same process from which the earth had emerged. But the sun was not the only source of the heat absorbed by our earth. Twelve millions of suns were constantly diffusing light upon its surface. Then we had internal sources of heat, such as volcanoes; and artificial heat, such as that caused by all movement or by chemical action—the latter source being, perhaps, the more important of the two.

In the fourth and last lecture the lecturer confined himself principally to the subject of electricity. Thales, by the friction of amber, had first observed this class of phenomena; but from that time—nearly two thousand years ago—until about two centuries since, the whole question slumbered. Then it was noticed that the property of attraction was not confined to amber, but was shared by many other objects also, for instance, sulphur and paper.

Passing from the discoveries of Mr. Gray, who had first began to trace out the difference between conductors and non-conductors, to the investigations of M. Dufait, and of the Hollander philosophers, who first made what is called the Leyden jar, the Professor at last reached the discoveries of Dr. Franklin. It seemed strange, he said, that the latter, in spite of his wonderful genius, should only have brought to light a very few facts and principles in relation to electrical phenomena. But these were of the greatest importance, interest, and value. Electricity was capable of the most wonderful influences upon human health. Many of the most marvelous effects and cures were possible under the use of this power, and some physicians in this city were now investigating its influence in cases of pulmonary disease. The patients breathed electrified air, and the most beneficial results had already been experienced. The voltaic battery, and the wonderful phenomena which it made possible, were so remarkable that on first watching the experiments made with it the Emperor Napoleon I. exclaimed, "Behold the principle of life." Sir H. Davy was the next great discoverer in electrical science, and he had succeeded in reducing the metallic bases of many of the salts and thus obtained some new metals, such as sodium and potassium. Next came the discovery of the relationship between electricity and the magnet, after which the history of this science became a series of the most dazzling and beautiful discoveries, under the auspices of M. Arago, Professor Henry, and others, while the practical applications of the principles thus brought to light were extremely interesting, the electric telegraph and the Atlantic cable especially claiming notice. Ere long the earth would be completely girdled with an electric wire. This was as certain as that we breathed. The galvanic effects of the electric current were also very extraordinary, and electricity was capable of producing the most intense heat known. The Professor then made some interesting experiments, and briefly referred to the phenomena of animal electricity.

## AMERICAN INSTITUTE LECTURES.---THE STRUGGLES OF SCIENCE.

The first of the course of the American Institute lectures for the season was delivered on the evening of Dec. 20, by Geo. B. Loring, M. D., of Salem, Mass.

On such a theme as the "Struggles of Science" there is great scope for eloquent dissertation, and the speaker availed himself fully of the opportunity. His remarks were listened to with evident satisfaction, and the lecture formed a most appropriate inaugural to the course.

The lecturer commenced by an allusion to the appropriateness of the place for scientific lectures. New York is more cosmopolitan in the character of its population, business interests, and trades, than metropolitan. While every other locality brings forth its specific fruit, and sends out its representatives marked with characteristics easily recognized everywhere, and under all circumstances, New York seems to absorb everything and send forth everything, attaching all her family to herself by that mysterious influence which power and greatness always exert, and developing faculties adapted to every locality—a Parisian for Paris, an Englishman for London, a Bostonian for Boston, a Puritan for Plymouth; and always a New Yorker still. Twenty cities, twenty nationalities, twenty civil organizations, as it were, all in one, what theory is not explored, what thought is not investigated, what science is not applied to vitalize and develop this wonderful aggregation of human forces?

The last 200 years have done more to advance science than the 2000 which preceded them. Turn your eyes in any direction, and you will find the most powerful human intellect engaged in this labor. The scientific period has arrived. The profound and masterly minds of the age, Humboldt, just now gone, Agassiz, resting for an hour only, as we trust, to return with renewed vigor to his imperial career in the realms of science, and their great investigating fraternity on both continents, have placed science at last in the divine regions of human genius, once occupied by the poets, and historians, and orators, and philosophers, who so long enjoyed undisputed sway as masters of human thought.

Religious persecution has done much to retard science, but this struggle was small in comparison to the contest which emancipated science from the tyranny of intellectual arrogance and pride. The great struggle commenced with the Baconian Era.

And now the great struggle commenced. Men still believed with Plato that science was a mere intellectual exercise and amusement; that the study of arithmetic was not intended for any practical service in life, but to habituate the mind to the contemplation of pure truth; that mathematics, applied to any purpose of vulgar utility, became a low craft, as he called it, fit only for carpenters and wheelwrights—and was no longer a noble science, leading men to the knowledge of abstract, essential, eternal truth; that the use of astronomy is not to add to the vulgar comforts of life, but to assist in raising the mind to the contemplation of things which are to be perceived by the pure intellect alone; that the science of medicine should be applied only to those whose constitutions are good, and not to those who by inheritance, or excess, or exposure, or accident, have become so permanently enfeebled that their heads grow giddy and full when exerted in the studious contemplation of divine philosophy—the remedy for feeble constitutions being death. That the science of legislation was based upon abstract virtue, and not upon that practical wisdom which would prevent and reform crime, and build up a state upon the principles of patriotism, and honesty, and courage, and honor, and furnish the highest faculties of man an opportunity to exert themselves "without being molested or insulted for it."

But this was not enough to satisfy the mind of Francis Bacon, who now assumed the leadership of the great scientific revolutions begun by him and carried out in our day by the devotees of science everywhere. Entertaining profound respect and admiration for the great thinkers of ancient times, and moving by his own natural forces along the same high plane of thought which they occupied, he stooped down and lifted into their august presence that useful, and manly, and homely attribute known as common sense. To be a philosopher meant, with him, to be the most useful man in the world; and so to him belongs the praise of having invented, methodized, and in a considerable degree perfected, the general plan for the improvement of natural science by the only sure method of experiment.

Instead of hypotheses he asked for facts, gathered laboriously from the watch of nature's silent revolutions, or extorted skillfully by instruments and trials, and carried forward by careful generalizations from the world of the known to the unknown. He reasoned always from causes to effects, and so impatient was his mind of mere abstractions that he never rested until he had brought his conclusions to some practical benefit. He clearly, for instance, conceived of a thermometer; he instituted ingenious experiments on the compressibility of bodies, and of the density and weight of air; he suggested chemical processes; he suspected the law of universal attraction, afterwards demonstrated by Newton; he foresaw the true application of the tides, and the cause of colors, which he ascribed to the manner in which bodies, owing to their different texture, reflect the rays of light." Ask a follower of Bacon, we are told, what the new philosophy as it was called in the time of Charles II., has effected for mankind, and his answer is ready: It has lengthened life; it has mitigated pain; it has extinguished diseases; it has increased the fertility of the soil; it has given new securities to the mariner; it has furnished new arms to the warrior; it has spanned great rivers and estuaries with bridges of form unknown to our fathers; it has guided the thunderbolt innocuously from heaven to earth; it has lighted up the night with the splendor of the day; it has extended the range of human vision; it has multiplied the power of the human muscle; it has accelerated motion; it has annihilated distance; it has facilitated intercourse, correspondence, all friendly offices, all dispatch of business; it has enabled man to descend to the depths of the sea, to soar into the air, to penetrate securely into the noxious recesses of the earth, to traverse the land in cars which whirl along without horses, and the ocean in ships which sail against the wind. These are but a part of its fruits, and of its first fruits. For it is a philosophy which never rests, which has never attained it, which is never perfect.

And what an era of emancipation was that in which Bacon wrought. Everywhere the bonds which had bound man's soul seemed to be breaking. Between the birth and death of Bacon, America opened her arms to receive the oppressed and persecuted. The Huguenots brought their protesting faith to our southern shores. The Puritans, who had kindled and preserved the "precious spark of liberty" in England, having sought shelter in vain in the Old World, braved the dangers of an almost unknown sea, defying with their fervid hearts the freezing storms of winter and the still more freezing storms of man's bigotry and persecution, and planted popular right and independent Christian worship in the New World—making sacred this very night on which we have assembled—the 215th anniversary of the last solemn hour spent by that weary band before they landed at Plymouth and gave an immortal soul to the empire of human equality on this continent.

In the world of thought, Shakespeare performed his divine and undying work. In the world of science, Harvey discovered the circulation of the blood; Drebel invented the thermometer; Torricelli invented the barometer; and Kepler erected as a monument to his genius the *Astronomia nova celestis*. It was the era of mental and moral protests and assertions, from which our own great privileges and opportunities have sprung.

From that period, the struggle which science had so long carried on against bigotry and intellectual arrogance has been conducted with a spirit of "audacity and sobriety" worthy of its great master, against the natural obstacles which lie in the way of finite man, in his endeavors to comprehend and employ the works of Infinite Wisdom. Once free, Science has not been disheartened in her career of usefulness and honor.

The speaker then discussed the usefulness of science in the discovery of the causes, prevention, and cure of disease, and the perfection of agriculture, and then passed to the subject of Social Science in America. He regarded with the deepest interest and the most profound respect that struggle which science is making to enter the great domain of social and civil economy, and to establish fixed laws by which society and the State may be guided and elevated. Met, as she is, on the very boundary of this domain by every variety of human taste and necessity, by a great diversity of social and civil organization, by all the various opportunities and obligations which attend the geographical divisions, the mountains and plains, and sea coasts and islands, by a thousand industries new and old, and by all the established systems of society and State, every one of which virtue irradiates and vice deforms, her task becomes at once difficult, her temptations great, her danger imminent. If there is any field in which she is to exercise the soberest judgment, it is here. If there is any investigation in which facts are to be collected, arranged, and weighed, it is where the prosperity, and happiness, and elevation of the human race are concerned. The soundest political philosopher is he who, gathering together all those causes of prosperity, general, diffused, and attended by popular virtue, which history provides, accepts the lesson which they teach, and promulgates the laws which they indicate; not he who starts with his theories and lends to them his facts.

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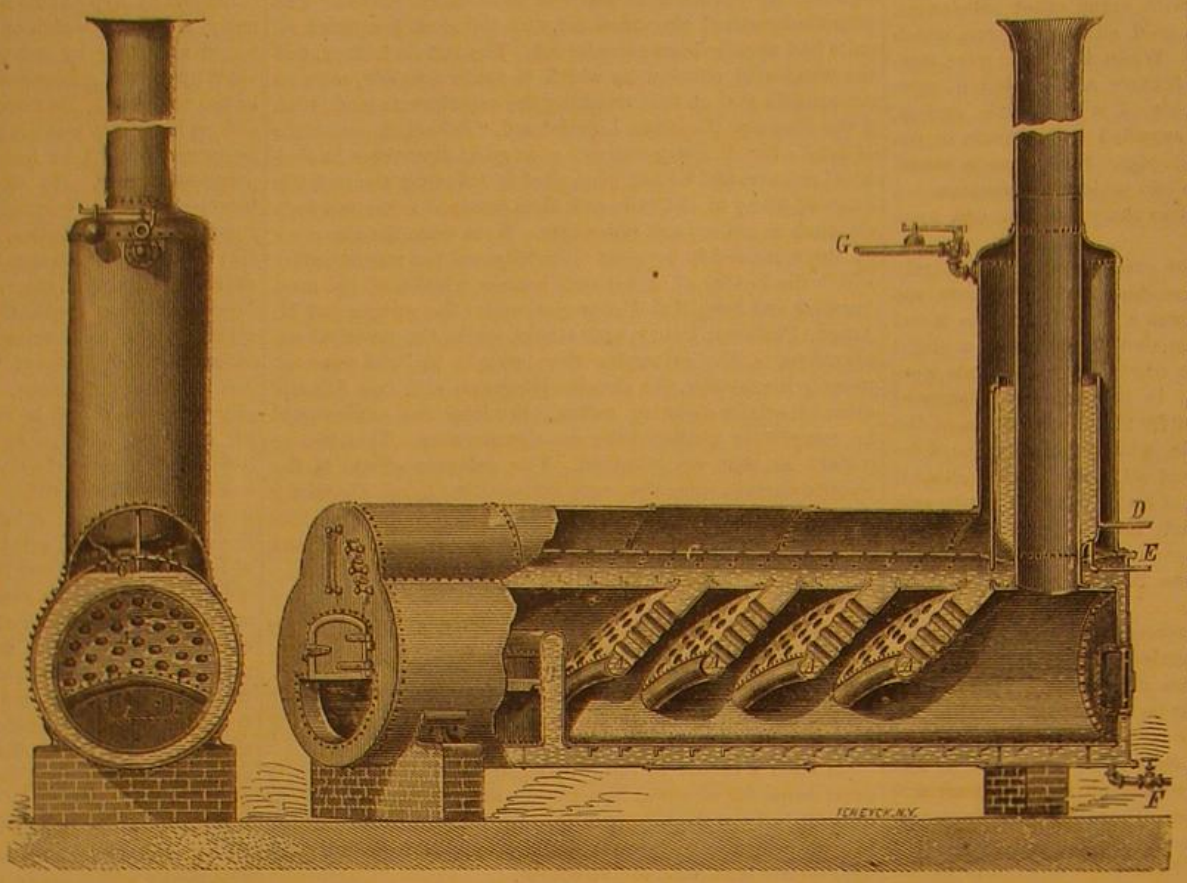
It is reported that the Central Pacific Railroad Company have purchased the Central Utah Railroad, and intend to push it through to connect with the Kansas Pacific Railroad.

### Improved Steam Boiler.

The well known want of economy in steam boilers in general, whereby much less than the total heat generated by the combustibles used is utilized in the generation of steam, is constantly stimulating invention in this important branch of engineering. One device follows closely upon the heels of another, and still it would seem the end is not reached. Our engraving represents another claimant to public favor, which, in a test made personally by us, on a recent occasion, gave very good results under quite unfavorable circumstances.

The boiler was set up on wooden supports, entirely unclothed, exposing a large amount of radiating surface to a mean temperature in the boiler house of 55° Fah., which temperature was maintained at a much higher point than could have been the case were it not for the radiation from the boiler itself. The stoking was done very imperfectly, by an inexperienced person, yet, with these drawbacks, in an experiment of four hours' duration, the evaporation made was 11·37 lbs. of water at 212° per pound of coal consumed. Great care was taken to avoid error in the estimation of the coal in the grate at the commencement and close of the experiment. As the experiment was too short to be satisfactory, there might have been some error in this particular; but, allowing ten per cent of the total evaporation as possible error, there would still remain 10·24 lbs. of water evaporated per pound of coal consumed, which is a very good result.




IMPROVED STEAM BOILER.

The dimensions of this boiler were: length, 15 ft.; diameter, 3 ft; heating surface, counting two thirds of inner shell, 68,995 square inches; grate surface, 962 square inches. The tube sheets—of which there may be any number—are placed at an angle of 45°, bringing every tube at the same angle to the flame. The cylindrical form of the outer shell continues, being perforated beneath the domes, which extend the length of the boiler and up around the smoke-pipe. Around the lower part of this is what may be called the feed-water heater, D, being the feed pipe. As the water is continuously pumped into the boiler, it is claimed that all the greater impurities of the water are deposited in this chamber, and blown off through the blow-off pipe, E.

Above this there is a small superheating space, which it is claimed more than overbalances any slight condensation which might be caused by feed water. F is a blow-off pipe from the bottom of the boiler.

This boiler has been constructed with the object of retaining all the advantages of the multitubular system, and rejecting many of its defects.

In the locomotive tubular boiler it has been found that the flame, in passing through the long tubes, is generally completely extinguished when it has passed through the first half of the tubes, and hence Chas. Wye Williams found that the first tube sheet, with the first foot or two of the tubesdid fifty per cent of the work, and that the gases, in passing through a horizontal tube, never strike the face of the tube, but pass through what may be called a tube of air lining the iron, and, heating this column of air, thus heat the water.

In the boiler here illustrated, both sheets and tubes set at an angle to the flame, which, to progress, must strike the face of every tube; and the tubes being only six inches long, the flame, after passing through them, instead of being cut up and extinguished, as in long tubes, here comes together and gathers body as it rushes against the next sheet and tubes.

The first two series of tubes are two inches in diameter, and the last two one and a half in diameter—the object of thus graduating them being apparent. The inclination of the tubes (45°) does away with the necessity of scraping, and the ash falling to the bottom is easily withdrawn through the man-hole.

The shortness of the tubes gives a minimum of expansion and contraction. Should repairs be necessary, easy access may be had through the man-hole and up between the sheets, the bottoms of which are curved for this purpose, and also to afford the most perfect circulation of the water; and by cutting the end rivets the whole inner shell may be withdrawn.

Aprons are placed beneath the second and fourth series, compelling the gases to take the proper course. In the marine boiler of this construction, the flame passes back to the front of the boiler, through a series of tubes placed at the opposite angles, thus exposing the same surfaces and with the same effect; and when the water is at the proper waterline, the tubes cannot be exposed by rolling of the vessel.

A patent on this invention was issued Nov. 29, 1870, by mense assignment, to C. D. Tyler, of New York. The whole or an interest in the patent is now for sale. Particulars obtained by addressing the owner, C. D. Tyler, 359 Broadway, New York city. P. O. box 2865.

### Holdredge's Patent Rectangular Cheese.

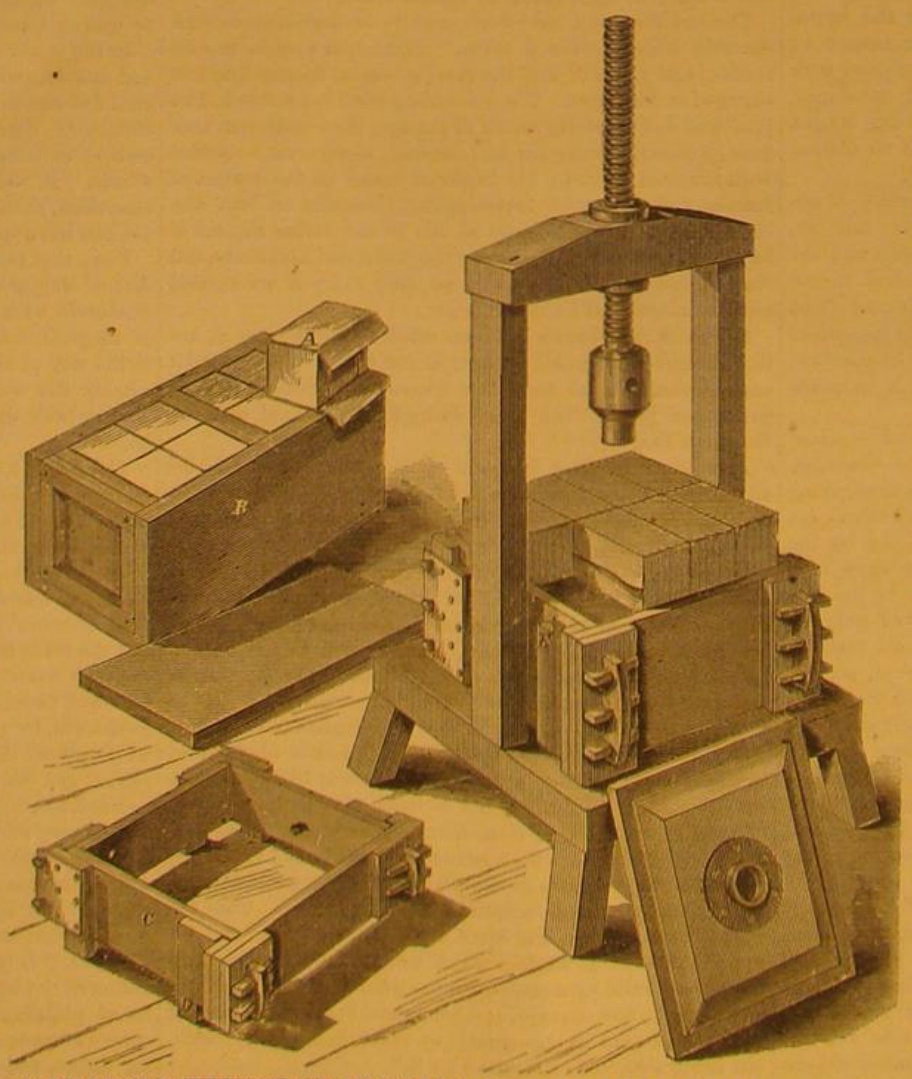
Our engravings represent a unique method of pressing, curing and packing cheese, for which the following advantages appear to be justly claimed: The cakes may be turned only a quarter of the way around instead of entirely over, as in the old form, so that the whey, instead of running directly back into the center of the cheese, will remain near the surface and evaporate more quickly. The cakes, being entirely covered by the bandages, may be cured without greasing. They are also more easily handled than round cheeses. They are packed for shipping in boxes of thin stuff, which any farmer may make himself, and the boxes have no loose covers to come off in handling. The cleats on the outside of the boxes prevent their being packed too closely, and also make them more convenient to handle. The form of the cheeses is more convenient for retailers, as well as for family use. For exportation this form is claimed to greatly excel the ordinary shape, as it can be packed closer. Shipments of cheeses of this form have been already made to England, with great success.

In the engraving, A represents one of the rectangular cheeses, partly wrapped in its bandage. B is the packing box, showing the manner of placing the cheeses therein. C represents the form of hoop used to increase the capacity of the hoop on the press, when necessary. It is provided with lugs, D, which fit into corresponding recesses, E, in the main hoop, which keep the supplementary hoop in its place.

When the curd is ready for pressing it is placed in the hoop—of rectangular form, as shown—and having one side arranged to swing open on hinges, for the removal of the cakes after they are pressed. The curd is then pressed into a broad, flat cake. This is cut vertically into blocks, as shown, and bandaged as shown at A, with muslin. The bandaged cakes are then placed in the hoop in layers, as shown, with thin boards between, and again pressed, by which the whey is still further removed, especially at the freshly cut sides of the cakes.

After they are sufficiently pressed they are turned a quarter round vertically and again pressed, and so on till all the sides are pressed.

When the pressing is completed the cakes are placed on shelves, for the evaporation of the remaining whey, and this, it is claimed, is greatly facilitated by the form of the cakes, as above specified.




HOLDREDGE'S METHOD OF PRESSING, CURING, AND PACKING CHEESE.

Patented through the SCIENTIFIC AMERICAN Patent Agency, Dec. 28, 1869, by Artemas Holdredge.

For information, address A. Holdredge & Co., West Burlington, N. Y.

### Cooper Institute Telegraph School.

We had the opportunity, a few days ago, of witnessing the Cooper Telegraph School in operation. Twenty-three young girls, averaging sixteen years of age, sat at the various desks endeavoring to send messages to each other. It was interesting to notice the progress each had made, and it was comparatively easy to tell which would succeed. The easy touch of the key, the depression of it without excitement of the head or body, the sharp introduction of the dot after a dash, as in the letter n, or d, or j, all indicated the operator. We cannot suppress the thought, however, that it is a mistake to teach an operator without the use of the register. An operator should be compelled to make letters exact; and to do this, they must be seen. Such, at least, is our conviction. Once thoroughly drilled in the formation of letters, they are never afterwards forgotten. And yet we confess to the excellence attained at this school, and the correct manipulation manifested by its graduates.

Over fifty graduates have now left the Cooper Institute, and have the management of offices or serve in them. The classes are now doubled from their original size, and over fifty may now graduate annually. Whether the demand will increase with the capacity of the school, remains to be seen. Pupils are dismissed who, after four months' practice, display a want of aptitude in transmitting or receiving. Of the present class only two are regarded as doubtful. All we saw seemed intelligent and diligent.

The room occupied for the school is comfortable, well lighted and aired. Every duty connected with a telegraph office is carefully taught, such as book-keeping, care of batteries, counting of words, preparing reports, etc., so that to graduate from the school is to be eligible for appointment. We think that in the very nature of the business the service of women in connection with the telegraph must be largely increased, and that, too, without reducing the service of men.

BLASTING EXTRAORDINARY.—At Tregarden Quarry, Luxulion, Cornwall, England, the property of the South Cornwall Granite Company situated on the lands of Mrs. Foster, of Castle, probably the largest block on record ever blasted and entirely removed from its bed at one time, was separated on Nov. 26, by one charge of powder weighing 20 lbs., supplied by the Cornwall Blasting Powder Company. The rock thus removed consists of a splendid quality of granite, measuring 41 ft. 6 in. in length by 34 ft. in breadth, and 8 ft. 6 in. in hight.

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## SIX MONTHS OF PROGRESS IN ENGINEERING.

One of the most notable engineering works of modern times, the East River Bridge at New York, has made considerable progress during the six months that are past. No accidents of importance have occurred. All difficulties seem to be foreseen and provision made to meet them as they arise. It is extremely interesting to see a work of this magnitude progressing with such ease and certainty, and the fact demonstrates the great advances which modern engineering can boast. The particulars of construction and the present stage of the work have been so recently placed before our readers that we need not dwell at any length on its details.

The caisson on the Brooklyn side has, since our former notices of the work, been sunk to its final resting place, and the work of filling up the cavity will soon be commenced. The caisson was commenced in November of last year, and the work of sinking it began in March last. The foundation now rests forty-five feet below low-water mark, thus placing all the timber completely beyond the reach of the water. The entire structure weighs about 30,000 tuns, to support which fourteen stone piers have been erected throughout the different chambers into which it is divided. The stone tower to be erected, for which the caisson will constitute the foundation, is to be 270 feet high, while the floor of the bridge will be 118 feet above the water. The caisson for this side of the river is being now constructed, and will be launched some time early in January. In its erection several improvements suggested by experience with the one just completed, have been made.

The great bridge at St. Louis is also familiar to our readers, and through Capt. Ead's report, extracts of which have appeared in this journal, they have been put in possession of facts relative to its present status. These bridges each presents peculiar difficulties, which it has been the triumph of modern engineering to overcome. When completed they will stand among the most notable structures of their kind ever erected.

The Hoosac tunnel, we are happy to say, under able direction is now making steady and, considering the nature of the work and the extraordinary difficulties attending it, even rapid progress. The facts connected with this great work are too familiar to our readers to be referred to in detail here, as the progress made, with interesting and minute details, are laid before them as fast as new facts are developed.

The Mont Cenis tunnel was announced to be completed in December, 1870, and as we have received no advices that indicate possible disappointment, that work is, at the time we go to press, probably completed.

The Darien Canal Survey, under the direction of Com. Selfredge, has resulted in a favorable report as regards the San Blas route from Mandinga Bay, on the Atlantic, to Chepo, at the southern end of Panama Bay on the Pacific. Further investigations are in progress.

The treatment of sewage has been studied with great earnestness during the entire year. It has now become a mixed mechanical and chemical problem, the importance of which is second to no other in modern engineering. It is attracting the attention of the ablest minds and must soon reach a satisfactory solution.

Street paving is another problem which is receiving much attention. Inventions multiply, and innumerable experiments are tried, most of which fail to give satisfactory results. The difficulties to be overcome are numerous, but the reward to him, who shall finally so far succeed as to place himself beyond the reach of competition, will be very great.

The loss of the British iron-clad, *Captain*, has elicited much discussion calculated to throw some doubt upon the sea-going qualities of very heavily-clad vessels, and is likely to modify in an important manner the construction of future vessels of the same class.

Many minor civil engineering works of greater or less importance have been begun or completed during the publication of the present volume, which we cannot enumerate at this time.

The system of propelling boats by cables laid in the beds of rivers and canals, is making great headway in Germany. Such cables are now successfully working in the Danube, the Rhine, and several other smaller rivers as well as canals. It is claimed for the system that it saves one third the expense for power attending the use of paddle wheels.

In steam engineering there has been no marked progress. Numerous minor devices, many of which have been described and illustrated in our columns, have been originated, but these inventions pertain mostly to safety appliances, rather than to the more economical generation and application of steam to the performance of work. The sectional tube system in boilers has received a great impulse from the many disastrous explosions which occur of late with shocking frequency, and is daily growing in popularity with a certain class of steam users.

The use of steam on common roads is also growing in favor, and daily extending. Steam plowing also is gaining ground, and has undoubtedly a brilliant future in store.

The direct application of solar heat to the generation of steam has been again prominently brought before the public, through the published experiments of Capt. Ericsson.

In mechanical engineering there is little of note to record, although the past six months have been prolific of new and useful minor inventions. Those who complain of the rate of progress made, must remember that great discoveries do not generally follow each other in quick succession, and possess their souls in patience. Man is slowly but surely subduing the brute forces of nature and bringing them under subjection to his never-satisfied will and desire.

## PROGRESS OF CHEMICAL SCIENCE.

Professor Roscoe has sent us a copy of his address to the Chemical Section of the British Association at Liverpool, September 15, 1870, from which we gather some interesting information on the recent progress of chemistry.

With regard to the position of chemical science at the present time, the learned Professor says that it will not take a careful observer long to see that in spite of numerous important and brilliant discoveries, of which every year has to boast, we are really but very imperfectly acquainted with the fundamental laws which regulate chemical actions, and that our knowledge of the ultimate constitution of matter upon which these laws are based is but of the most elementary nature. Take for example the Atomic Theory. This has been freely used by chemists to enable them to explain chemical phenomena, and some authors regard the existence of atoms as the very life of chemistry. Dr. Frankland, on the other hand, cannot understand action at a distance, nor the discontinuity of matter, an idea lying at the base of the notion of atoms. Professor Brodie thinks that the science of chemistry neither requires nor proves the atomic theory, while Sir William Thomson attempts to form an idea of the size of atoms and molecules, and states that in any ordinary liquid, the mean distance between the centers of contiguous molecules is less than the hundred-millionth and greater than the two thousand-millionth of a centimeter.

In this connection the labors of the late Professor Graham are gratefully remembered. This philosopher paid special attention to the molecular properties of gases. "What do you think," he writes to Hofmann, "of metallic hydrogen, a white magnetic metal?" The condensation of hydrogen in palladium, and the discovery of the occlusion of hydrogen in meteoric iron, confirmed the conclusion to which spectrum analysis had previously conducted us, that the meteorites came from an atmosphere of incandescent hydrogen existing under very considerable pressure. Graham's fame as one of England's greatest chemists justly rests upon this important discovery. In addition to the blow given to our preconceived notions of atoms, Professor Roscoe refers to the researches of Dr. Andrews on the continuity of the liquid and gaseous states of matter, thus overthrowing our cherished opinions on the existence of three separate states or conditions of matter, viz., the solid, liquid, and gaseous. Dr. Andrews believes that a large number of easily condensable gases or vapors possess a critical point of temperature, at and above which no increase of pressure can be made to effect a change into what we call the liquid state, the body remaining as a homogeneous fluid, whilst below this critical temperature certain increase of pressure always effects a separation into two layers of liquid and gaseous matter. The boldness of modern research is exemplified in the observations of Lockyer and Zollner on the pressure acting in the different layers of the solar atmosphere. The red flames, chiefly composed of hydrogen, which shoot forth from the sun, must have burst out from under great pressure, and Zollner arrives at the conclusion that the difference of pressure needed to produce an explosion capable of projecting a prominence to the hight of 80,000 English miles above the sun's surface (a hight not unfrequently noticed) is 4,070,000 atmospheres. In order to produce a tension capable of overcoming this gigantic pressure, the difference in temperature between the inclosed hydrogen and that existing in the solar atmosphere must be 74,910° C.! and in a similar way Zollner calculates the approximate absolute temperature of the sun's atmosphere to be 27,700° C. or eight times as high as that given by Bunsen for the oxyhydrogen flame, a temperature at which iron must exist in a permanently gaseous form. Professor Roscoe also alludes to a new galvanic battery invented by Bunsen. In this second battery only one liquid, a mixture of sulphuric and chromic acids, is employed. The plates of zinc and carbon can be lowered at once into the liquid and raised again at will. The electromotive force of this battery is to that of Grove's (the most powerful of known forms) as 25 to 18; it evolves no fumes in working and can be used for a very considerable length of time without serious diminution of the strength of the current.

A very important bleaching agent discovered by Schutzenberger, is called hydrosulphurous acid and has the formula of $H_2SO_2$. The sodium salt of this new acid is obtained by the action of zinc on the bisulphite. The hydrosulphurous acid possesses powerful reducing properties and bleaches indigo rapidly. At a time when so much attention is bestowed upon disinfectants and antiseptics there ought to be experiments conducted with this new agent.

The interesting researches of Matthiessen and Wright on morphine and codeine have thrown a new light on the constitution or these opium alkaloids. Treated with hydrochloric acid morphine loses one molecule of water and gives rise to a new base, apomorphine, which differs in a remarkable manner from morphine, both in its chemical and physiological actions, being soluble in alcohol, ether, and chloroform, whereas morphine is nearly insoluble, and acting as the most powerful emetic known, $\frac{1}{10}$ of a grain producing vomiting in less than ten minutes.

The discovery of the sedative properties of chloral-hydrate by Liebreich marks an era in medical chemistry second only to the discovery of the anæsthetic properties of chloroform.

The discovery of the artificial production of alizarine, the coloring matter of madder, which was announced a year ago, now appears likely to be worked out on a practical scale; it is the artificial production of a natural vegetable coloring substance which has been used as a dye from time immemorial. One of the most important discoveries of recent times is a method proposed by Dr. Mond for the utilization of what has long been known as soda waste. The insoluble monosulphide of calcium is oxidized to the soluble hyposulphite, and by decomposing this salt by hydrochloric acid, all of the sulphur is deposited as a white powder. In this way the greater part of the sulphur used in the production of salt cake by Le Blanc's process is reclaimed and a great saving is thus effected to the alkali manufacturer.

Another discovery of almost equal magnitude relates to the recovery or regeneration of the black oxide of manganese used for the evolution of chlorine in the manufacture of bleaching-powder. This subject has long attracted the attention of chemists, and during last year a very simple and economical process, proposed by Mr. Weldon, has obtained recognition and is now worked by more than thirty-seven firms in Great Britain. The process depends upon the fact that although when alone the lower oxides of manganese cannot be oxidized by air at the ordinary temperature and under the ordinary pressure to the state of binoxide, yet this is possible when one molecule of lime is present to each molecule of the oxide of manganese. The oxide of manganese is precipitated from the still-liquors with the above excess of lime, and by the action of the air on this a black powder, consisting of a compound of the binoxide of manganese and lime, is formed, which is capable of again generating chlorine on addition of hydrochloric acid, and thus the chlorine process is made continuous, with a working loss of only 2½ per cent of manganese.

The last important discovery alluded to by Professor Roscoe is a process for the direct production of chlorine from hydrochloric acid without the use of manganese at all. In the presence of oxygen and of certain metallic oxides, such as oxide of copper, hydrochloric acid gas parts at a red heat with all its hydrogen, water and chlorine being formed.

The mixture of air and hydrochloric acid gas is passed over red hot bricks impregnated with copper salt. The oxide of copper acts as by contact and remains unaltered, while the chlorine, watery vapor, and excess of air pass at once into the lime chamber. Some practical difficulties have been encountered in the working of this process, but there is every prospect of its ultimate success.

We have thus given an analysis of Professor Roscoe's admirable discourse, and have passed in review the prominent chemical discoveries of the year. It will be seen that some of the recent discoveries are of great practical value.

## THE SOLAR ECLIPSE OF 22D DECEMBER, 1870.

The line of totality stretches from the North Atlantic across the south of Spain, passing over Cadiz, then over Algeria, thence over Syracuse, in Sicily, into Turkey, Greece, etc. The duration of the eclipse will not vary much from two minutes at any place, too short to make the eclipse a very important one, and still less so from the low altitude of the sun. Congress has appropriated nearly $30,000 to equip observers, and we believe, after a good deal of pressure, the British Government has provided a ship and $10,000 for a similar purpose.

The astronomical data derivable from a solar eclipse are of two kinds: one respecting the moon's motions, the other the physical constitution of the sun. The first is not important just now, but we may observe that the moon, coming against or in front of the sun, allows an observation of our satellite's place in the heavens to be made at a very central point in her orbit. This is of importance to mathematical astronomy, but can only be properly made at a fixed observatory, which need not be on the line of totality.

The expeditions above referred to must devote themselves to the acquirement of physical and cosmical knowledge, from appearances which are only shown when the disk of the moon

completely hides the disk of the sun, and permits the view of certain solar surroundings, otherwise too faint to be seen. These surroundings are of two-fold character. First, there is a silvery white glowing radiation of considerable breadth, which encircles the moon, apparently, but doubtless the sun really. This has been seen in eclipses from the earliest times, and is known as the "corona;" second, there is, close to the sun, a narrow rim of bright red excrescences, first seen during an eclipse in 1706, supposed to be an atmosphere round the moon. This phenomenon seems to have been forgotten, until observers of the eclipse of 1842 saw, at the instant of totality, flame-colored masses of light protruding from the lunar disk. From that time this light became the chief feature of a solar eclipse. In 1860, it was settled by aid of photography that this light came from the sun. In 1868, the spectroscope was used, and showed that these red excrescences are part of a shell of glowing gas surrounding the solar globe. Since then, this light has been seen without an eclipse, even in the dazzling rays of the sun, owing to properties of the spectroscope in dilating the heterogeneous light coming from the sun's general surface, while it allows to pass unaffected the homogeneous light emanating from gaseous bodies, such as these excrescences prove to be, which were seen by turning the spectroscope to the edge of the sun. The sun was virtually put out by spreading its light over such an area as to make the resulting brightness less than that of the prominences—the light of which will not spread itself—and then these were clearly seen. These prominences are but the higher parts of an irregular and tempestuous atmosphere of glowing gas, which cover the whole globe of the sun.

What are familiarly known as "Baily's beads" no longer attract the attention of eclipse observers. They seem due simply to the sun's light glancing between the mountains on the edge of the moon, just before totality. The "corona" will be the absorbing phenomenon, doubtless, in the present eclipse. Theories concerning it exist in plenty. Some call it a glare in our own atmosphere, but the whole of it cannot arise from this cause. Some regard it as an atmosphere of the moon, but this idea is quite untenable. It may be an atmosphere about the sun; it may be a dense portion of the zodiacal light; but these are hypotheses. For a fact, we only know that a bright part of the light near the sun seems to be tolerably persistent; and that fainter outlying parts, which shoot out two or three times the sun's diameter, seem to vary their form during an eclipse, and to present different appearances to different observers. To acquire more facts, we have photography, the spectroscope, and the polariscope. The former of these will probably determine whether the silvery light comes from a luminous gas, or from solid matter in a state of incandescence, or it will show if both qualities of light are present. The polariscope will determine whether the light is the corona's own self, generated luminosity, or reflected sunlight. To analyze the light of the corona, and attempt to decide its source, must be the main ends of the coming observations. Chiefly to solve this eclipse enigma have we sent some of our highest official philosophers to Europe, and the result of their labors will be awaited with much interest.

## TESTING THE STRENGTH OF BOILERS BY STEAM PRESSURE.

We have seldom heard of a greater piece of stupidity than one, the details of which have been kindly forwarded to us by a correspondent from Knoxville, Mo.

It seems some mechanics had been repairing a steam boiler at Hamilton, near Knoxville, and endeavoring to test the strength of the boiler by steam pressure, succeeded in bursting it, and killing four persons, and injuring ten more.

The boiler was a locomotive boiler, tho flues of which had been in bad condition for some time.

A Knoxville paper states that, "after fixing them as well as they could, they built a fire and started up to test their work, after a short trial it was found that the flues were not in as good a condition as might be, they put out the fire for the purpose of letting the boiler cool down, and after making some further repairs they again fired for the purpose of starting up. It seems now that these machinists had determined *to find how much steam to the square inch it would bear*, they kept firing, and neglected the water until it was quite low. One of them remarked that the water in the boiler was getting low, and requested the other to turn on the water. It is thought that the boiler at this time must have been red hot, but whether this is true or not, we are unable to learn. As soon as water commenced running into the boiler, it went asunder, dealing death and destruction, and destroying everything before it."

What a sad exposition of the ignorance which prevails among those who use, and even are entrusted with repairs of, boilers. Surely our Boston correspondent who recently called attention to the prohibition of unsafe boilers, might now find a text for a sermon on the prohibition of ignorance and stupidity in those who are allowed to have anything to do with boilers or engines.

Steam, all powerful as a destructive agent, as well as in the performance of useful work, has no business to be in the hands of the ignorant, careless, or stupid. It is only to be safely intrusted to active intelligence and untiring vigilance. Now pass through the legion of boiler rooms in this country, and note the general average of these desirable qualities in the persons in charge. In a comparatively few you shall find all the required qualities for safe and efficient foremen. In the majority you will find men ill paid, because their services are worth little, employed by parsimonious proprietors because they can be hired cheaply.

How often we have shuddered at seeing a large establishment filled, perhaps with working women and children, whose lives were hourly in jeopardy from the ignorance of some block-head down in the boiler room.

Now let us make a practical suggestion. Let a law be passed empowering duly appointed and competent inspectors to examine not only boilers, but persons in charge of them, and invest the inspectors with authority to compel the discharge of persons incompetent because of want of knowledge, of intemperate habits, or any other cause. Let this be done, and we shall have less of boiler explosions, and destruction of life resulting therefrom.

## STANDARD PUBLIC TIME.

In this busy age, when the forces of nature are hurling huge masses of matter with breathless swiftness in all directions over the surface of the civilized world, and when the exigencies of business require the utmost punctuality, it is becoming daily more important that some fixed public standard of time should be established.

In many cities there is a local standard. For instance, such a standard for London is supplied by a clock in the Greenwich Observatory, and communication by electric currents with other clocks in various parts of the city is made to regulate these subordinate time-keepers, and thus to regulate the general time of the city.

In Liverpool the standard time is controlled by the Liverpool Observatory.

In Edinburgh there are time-bells and time-guns governed by a control clock in the Observatory at that place.

The most complete system of regulation is, however, attributed to Glasgow, Scotland, in which ten public clocks are controlled at an average distance of three miles from the observatory.

At Madras, India, five time-guns are fired at noon of each day by a current sent from the Madras Observatory.

At St. Petersburg, Russia, the clock of the Public Library, one at the Admiralty Buildings, and one at the Central Telegraph Station, are controlled by one at the Imperial Observatory.

In Washington time-bells are rung from the Central Fire Alarm Station and at the various police stations, at noon of each day, these signals being controlled by the astronomer in charge at the Naval Observatory.

In Albany a time ball is dropped at noon of each day by a current sent from the standard clock of the Dudley Observatory.

Cleveland, Ohio, and Chicago, Ill., have also standard time furnished them from astronomical observations.

In New York we at present have no standard time. Fire bells were formerly rung by currents sent from Mr. L. M. Rutherford's observatory, and subsequently arrangements for obtaining time from the Dudley Observatory at Albany were commenced, but never brought to completion.

Boston, though within easy reach of five observatories, at present has no standard time. We have collected these facts in part from the report on Standard Public Time, of the committee appointed by the Common Council of Cincinnati to investigate the subject and report upon the same. At Cincinnati is located one of the most important of all the observatories in America, yet up to October, 1870, at which time the report referred to was made, it had no uniform time.

The report approves what is known as the "Jones" system of regulating clocks, as the most successful and useful. In this method the electric fluid is employed merely as a regulating agent, and not in any case as a motive power; the timepiece under control being an ordinary clock, connected by a regular succession of electric pulsations with the normal mean-time clock of the observatory. The application of the invention in Glasgow has been perfectly successful. It has been employed under various forms; but what Prof. Grant, of that city, considered to be the most suitable to the requirements of a large city, was the small clock with a second pendulum and a dial of about three feet in diameter, showing the time to hours, minutes, and seconds. Clocks of this construction have been set up in the public thoroughfares of Glasgow, and have been found to be exceedingly useful.

The estimated expense of supplying the city with uniform time, is given as $2,500 for the first establishment, and $1,060 per annum as the current expenses for repairs and attendance.

These figures show that the cost for standard time to New York would be small, while its benefits would be large in proportion to those of other improvements much more expensive in character.

There seems, moreover, little reason why uniform time could not be supplied with sufficient accuracy from the numerous American observatories to smaller towns lying along the principal railway and telegraph lines. In a scientific as well as a practical point of view, the supply of such standards is every way desirable.

## THE USES OF DISSOCIATION.

The uses of association are known to all mankind. We have association for every conceivable object, but no one has ever discovered a use for dissociation until it occurred to a French chemist to adopt this word, and the principle involved in it, to many important technical applications. We suppose that very few of our readers ever heard of the word dissociation or have any idea of its meaning; and for the benefit of all such, we prefer to say something about it, as it bids fair to become an important agent in technology. The word was first proposed by Deville, in 1857, although some of the experiments mentioned by him had been performed by Priestley, Grove, and others, many years previously. The idea intended to be conveyed by the word is that of dis-association, or the rending asunder of compound bodies and their resolution into their elements by heat. When the elements are in a state of dissociation in which the laws of affinity no longer have any play, they are not attracted to each other until sufficiently cooled down to bring them within the action of affinity, and may be considered as lying about loose in space like the nebulæ under La Place's theory of creation, or the gases in the atmosphere of the sun. Grove showed that fused platinum could determine the decomposition of water into its elements the same as the galvanic battery, and Deville thinks that at the melting point of silver, water is dissociated and no longer exists as water. If this be true it goes to show that the opinion of many engineers that boiler explosions may sometimes be traced to the formation, at a very high temperature, of an explosive mixture of hydrogen and oxygen, may possibly be true. Deville met with a dangerous accident by the explosion of a quantity of the oxy-hydrogen gas produced by pouring considerable fused platinum into water. The gases came off violently, and were fired by the hot metal. To avoid further danger he modified his experiment in the following manner: In a furnace capable of producing a heat of 1100° to 1300° Cent., he placed two tubes, one within the other, and through the interior tube, made of porous clay, he caused to pass a gentle current of steam, and through the annular space of the outer tube a stream of carbonic acid gas. A part of the vapor of water was decomposed or dissociated—the hydrogen passed through to the outer space, and the carbonic acid joined the oxygen in the inner tube, and was separated from it by being passed through lime water. In this way water was dissociated without the danger of explosion. The experiment would seem to point to the feasibility of decomposing water in a furnace, and burning the products for the production of high temperatures. Debray subsequently discovered that solid bodies composed of fixed and volatile constituents obeyed the same laws, and that the volatile constituent could be dissociated by heat; for example, marble could be decomposed and the carbonic acid be expelled, but if there was no opportunity for the gas to escape it quietly recombined with the lime on cooling. Isambert has pursued the subject still further, and has constructed tables of the temperatures of dissociation of numerous bodies and of the co-efficient of expansion of their vapors, and Lamy has made a practical application of the whole subject in the construction of a pyrometer for the measurement of very high temperatures and a thermometer for low temperatures.

The pyrometer consists of a porcelain tube glazed on both sides, closed at one end, and on the other brought into connection with a quicksilver manometer. The portion of the tube to be exposed to the fire is filled with pulverized Iceland spar and pure calc spar, or white marble; dry carbonic acid is introduced by heating one end of the tube, and the instrument is then attached to the manometer, and on cooling indicates that there is a perfect vacuum, and that all of the carbonic acid has been re-absorbed by the lime on cooling.

As the tension of dissociation of the carbonic acid increases with the temperature, and is constant at fixed temperatures, the degree of heat from 800° Cent., upward, can be accurately read on the scale of the manometer.

The instrument is remarkably simple, not likely to get out of order, and can be attached to any furnace, and is said to be more accurate than any hitherto invented. The thermometer founded upon the same principle of dissociation is composed of a copper box of the diameter of a five-franc piece, and seven to eight millimeters in thickness, into which is screwed a copper tube four to five millimeters in diameter and fifteen centimeters long. The box is filled with ammonia and chloride of calcium, and the dissociation of the ammonia is employed as a measure for the heat. A leaden tube can be soldered to the copper, which may be fifty or even a hundred feet long, and on the end of such tube is placed the mercury manometer. The tubes are first filled with ammonia, and the scale of the manometer is then adjusted.

For temperatures between 0° Cent. and 46° Cent. (32° Fah. and 83° Fah.), this thermometer is said to be remarkably sensitive, and as its action is wholly dependent upon the temperature of the box containing the ammonia salt, and it makes no difference where the manometer is placed, it is the best possible contrivance for measuring the temperature of inaccessible places, such as artesian wells, caves, shafts, the bottom of the sea, and the upper regions of the air.

Once put in order and hermetically sealed, there would appear to be no difficulty in keeping this apparatus in constant working order.

We have thus already two most important applicatios of the law of dissociation, and we may safely predict further uses in the manufacture of gases, in the construction of blast furnaces, so as to employ the dissociated gases just at the right moment, in the decomposition of water, and in affecting the analysis of all the bodies upon the face of the earth. The subject is well worth the attention of our engineers and chemists.

## FATAL EXPLOSION OF A GASOLINE RESERVOIR---A WARNING TO MECHANICS.

The recent explosion in 55th street, of a wrought-iron boiler in which gasoline had been stored, whereby a mechanic was instantly killed, ought to serve as a warning to all workers in the repairing of old cans, boilers, and gas holders. The occasion of the explosion in this instance was due to the mixture of atmospheric air with the vapor of naphtha contained in the vessel. On the day preceding the accident one of the workmen bored two holes through the iron, into which it was intended to insert two brass stop-cocks. Thus during the night there was an opportunity for the air to enter and the gasoline to escape, and a most explosive mixture was formed in the boiler.

The mechanic who was directed to insert the stop-cocks first heated a bar of iron red-hot and placed it over the holes, in order to warm them so that the solder would adhere. The

moment he did so the hydrocarbon of the gasoline vapor combined with the oxygen of the air that had been admitted over night, and there was a fearful explosion; as it is well known that red-hot iron, a glowing wire gage, hot platinum, and spongy platinum, or an electric spark, will at once explode a mixture of these gases.

Perhaps no foresight of a mechanic could have prevented the catastrophe, but a chemist who knew what had been in the boiler would never have touched it until all the gas had been expelled by previously filling it with water.

A somewhat similar accident occurred, a few months since, at Niblo's theater, where the oxygen receiver exploded in consequence of its having been previously used for storing naphtha, and a mixture of hydrocarbon gases and oxygen was contained in it. Hydrogen alone, or oxygen alone, do not explode, but mixed together, few things can equal the force of their explosion. At 55th street the boiler iron was torn as if it had been a piece of paper.

The lesson of the accident is that no mechanic should touch any can, lamp, boiler, or gas holder, until all explosive mixtures have been expelled by previously filling them water, or in some other way.

The person who sent the gasoline holder to be repaired was guilty of culpable negligence in not making known the uses to which it had been applied; but even if he had done so, it is doubtful if any workmen would have taken the precautions we have above indicated to prevent the explosion.

Never solder any suspicious vessel until you have filled it with water to expel any gas that may be in it, and you will be on the safe side.

## HARVEY BROWN.

Among the recent obituary notices we observe with much regret the name of Harvey Brown, of Harlem, N. Y., who died December 15th, aged 78.

In the earlier years of his life he was a Methodist preacher, to which laborious vocation all his best energies were devoted. His ministrations extended over wide circuits, were generally acceptable, and productive of much benefit among the multitudes also who sat under his instructions. He possessed a decidedly scientific and mechanical turn of mind; and during the later years of his life, having been relieved from the cares of pastoral labors, he found pleasure as well as reward in developing some of his many inventions.

He was the patentee of numerous improvements. Among them was the metallic lamp chimney, the lower portion made of glass, the upper part of metal, a device which saves chimney breakages to a great extent. He was also the inventor of a method of propeling street cars by means of a wire rope, to be mounted and run on poles, arranged on the sides of the street. Each car had a grab, controled by the conductor, who could connect or disconnect the car from the rope, and thus stop or start the car at will.

His cooking stoves, sawing machines, lumber-dressing machines, barrel machines, and other improvements, are of well-known practical character, and have been frequently noticed in our columns.

Up to within a short time of his decease he enjoyed good health and the perfect possession of all his faculties. He visited our office only a little while ago, to inquire about a new invention, on which he thought of taking a patent. No one could have suspected from his appearance that his age exceeded sixty, so elastic and vigorous were all his movements. His uniform good health and unimpaired activity, he once told us, were due to his regularity of habits and moderation in all things. Gentle, kind-hearted, unassuming, genial, he leaves behind him the proudest of records—that of having been a good and useful man.

### The Commissionership.

The report comes from Washington that Gen. M. D. Leggett, of Zanesville, Ohio, is likely to be appointed to fill the office of Commissioner of Patents, to fill the vacancy occasioned by the resignation of Hon. S. S. Fisher. For many years Gen. Leggett was superintendent of the public schools at Zanesville. He entered the military service as colonel of the Seventy-eighth Ohio Infantry, and by good service he rose to the several grades of brigade, division and corps commander in the campaigns at the West, under Grant and Sherman, serving with distinction from the beginning to the end of the war. He has been employed, since the war, as superintendent of manufacturing works at Zanesville.

SCIENTIFIC AMERICAN CLUBS.—In the formation of subscription clubs for the SCIENTIFIC AMERICAN some of our correspondents find that they can increase their lists by obtaining a portion of the names in one town and others in towns adjoining; they write asking if we will mail the SCIENTIFIC AMERICAN to the different postoffice addresses of subscribers to such club lists. In reply, we say, yes, certainly. We shall be happy to mail the papers to any address. We are in receipt of the most gratifying assurances from every part of the country, indicative of a large increase in the demand for the SCIENTIFIC AMERICAN for 1871.

PATENT OFFICE REPORTS.—Senator Anthony, from the Committee on Printing, has reported a resolution to print a condensed weekly report, and to send a hundred copies to the capital of each State, and to the Clerk's office for each judicial district. Provision is also made to enable every public library to possess itself of the books, simply upon the payment of the cost of binding.

NINE cars loaded with silver ore from Colorado passed over the Toledo, Wabash and Western Railway, a few days since, for Philadelphia.


## SCIENTIFIC AMERICAN.

### 1871.

**Special Club Premium.**

A New Volume of this journal commences on the first of January. Any person sending us yearly clubs for ten or more copies will be entitled to receive, free of postage or express charge, one copy of the celebrated engraving, "MEN OF PROGRESS," for every ten names.

This large and splendid Steel Plate Engraving is one of the finest art works of the day, possessing a rare and peculiar value over ordinary pictures, by reason of the life-like accuracy of the personages it represents. The scene of the picture is laid in the great hall of the Patent Office, at Washington. The grouping is spirited and artistic. Among the persons represented are the following eminent inventors:

S. F. B. MORSE,.....Inventor of Electric Telegraph.
CYRUS H. McCORMICK,.....Inventor of Reaper.
THOS. BLANCHARD,.....Inventor of Lathe for Irregular Forms.
WILLIAM T. G. MORTON,.....Inventor of Chloroform.
SAMUEL COLT,.....Inventor of Revolving Fire-Arms.
CHARLES GOODYEAR,.....Inventor of Rubber Fabrics.
FREDERICK E. SICKLES,.....Inventor of Steam Cut-Off.
HENRY BURDEN,.....Inventor of Horse-Shoe Machine.
JOHN ERICSSON,.....Inventor of the first Monitor.
JAMES BOGARDUS,.....Inventor of Iron Buildings.
JOSEPH SAXTON,.....Inventor of Watch Machinery.
PETER COOPER,.....Inventor of Iron-Rolling Machinery.
JOSEPH HENRY,.....Inventor of Electro-Magnetic Machine.
ISAIAH JENNINGS,.....Inventor of Friction Matches.
RICHARD M. HOE,.....Inventor of Fast Printing-Presses

These noble men, by their own efforts, raised themselves from the depths of poverty, and by their wonderful discoveries, conferred incalculable benefits upon the human race, entitling them to rank among its greatest benefactors. It is but fitting that the remembrance of their achievements, and the honored forms of their persons, as they lived and walked among us, should be perpetuated by the highest skill of art. The picture, which is three feet long and two feet high, forms an enduring and desirable object for the adornment of the parlor. It was engraved by the celebrated JOHN SARTAIN, from a large painting by SCHUSSELE, and all the portraits were taken from life. Every lover of Science and Progress should enjoy its possession. Single copies of the Engraving $9; Three copies, $25.

One copy of the SCIENTIFIC AMERICAN for one year, and a copy of the Engraving, will be sent to any address on receipt of $10.

MUNN & CO.,
37 Park Row, New York City.


## Queries.

*[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers, and hope to be able to make this column of inquiries and answers a popular and useful feature of the paper.]*

1.—RECHARGING OLD CARTRIDGES.—Can old copper cartridges which have been fired be recharged? If so, how?—C. W. H.

2.—CHEAP FURNITURE VARNISH.—I wish to get a recipe for a very cheap furniture varnish. Will some brother workman furnish me with one?

3.—LIGHT IN COAL PITS.—What are the lights used in English coal pits? Are candles used outside of the lamps?—J. B.

4.—BRASS DIP.—I wish a recipe for the cheapest and best dip for brightening brass paper fasteners?

5.—DISINFECTING ROOMS—CHEAP BATTERY.—What is the best way to disinfect a sick room? Also how can I make in the simplest way a good galvanic battery? Is not a galvanic battery better than an electro-magnetic battery for the sick?

6.—GRINDING CORN.—I have ground on a run of 34-inch stones sixty bushels of corn per hour into good meal. Can this be beat? The stones are run by steam power.—C. K.

7.—BLUEING AND BRONZING STEEL.—How can small articles of steel be blued or bronzed?—J. W. K.

8.—GALVANIZING GRAY IRON CASTINGS.—Will some one who has had experience direct me how to galvanize gray iron castings, not in general terms merely, but give the practical details?

9.—FILTERING WATER.—I have a cistern already built, and want to make a good filter. Will some one tell me how to do it?

10.—REMOVING VARNISH FROM CARVED WORK.—How can dried varnish be removed from carved work without injuring the wood?

11.—COLORING GOLD.—What are the ingredients and the proportions thereof in the solution used by jewelers in coloring gold jewelry?

12.—RE-SILVERING LOOKING GLASSES.—How can I re-silver old looking glasses, and remove spots from the same?—J. F. S.

13.—FURNACE FOR HOT BLAST.—What is the best, cheapest, and most economical furnace or stove by which to produce a hot blast to 500 or 600 degrees? What pressure per inch of area will a twenty or twenty-five horse power engine maintain through two or three tweers? Is a fan blower or piston bellows the best for maintaining a hot or cold blast in a cupola or chamber where the air requires to be compressed?—J. R. G.

14.—BLUEING SHEET STEEL.—Can any of your readers inform me how to give sheet steel a uniform blue color? I mean sheet steel as it comes from the finishing rolls of an ordinary sheet train.—J. W. R.

15.—OUT-DOOR GILDING.—How can I prepare gold leaf so as to apply it without difficulty in currents of wind out of doors? I am greatly bothered by these currents in doing this kind of work.—N. M.

16.—SUN DIAL.—How can I make a good sun dial?—C. B.

17.—GILDING.—How can I restore the gilding worn off from a sewing machine?—F. P. B.


# PATENTS.

## American and European.

MUNN & CO. continue to give opinions in regard to the Novelty of Inventions, free of charge; make special Examinations at the Patent Office; prepare Specifications, Drawings, Caveats, and Assignments; and prosecute applications for Letters Patent at Washington, and in all European countries. They give special attention to the prosecution of Rejected Claims, Appeals, Extensions, and Interferences.

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Back Numbers, Volumes, and Entire Sets of the SCIENTIFIC AMERICAN are for sale at low prices, by Theo. Tusch, 37 Park Row, New York.


## Answers to Correspondents.

*CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.*

*SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however when paid for as advertisements at $1·00 a line, under the head of "Business and Personal.*

*All reference to back numbers should be by volume and page.*

COLORLESS LACKER.—The following recipe for colorless lacker may answer "Indicator's" purpose: Dissolve 2½ ounces of shellac in 1 pint of rectified spirits of wine; boil for a few minutes with 5 ounces of well-burned and recently heated animal charcoal. A small portion of the solution should then be filtered, and if not colorless, more charcoa must be added. When all color is removed, press the liquid through a piece of silk, and afterward filter through fine blotting paper.—J. E. W., of N. H.

BORATE OF IRON.—A correspondent asks if there is such a salt as borate of iron. Rose prepared this compound in 1853, by adding bi-borate of soda (borax) to ammonia iron alum. It yields a pure brown voluminous precipitate, which, after being thoroughly washed and dried, is found to be composed of the borate of the sesqui-oxide of iron, contained with some hydrated sesqui-oxide. It is not likely to be for sale by ordinary druggists, but our correspondent can easily prepare it for himself.

RANGE OF GUNS.—"G. R." asks this question: "All other conditions being equal, which has the greatest ultimate range, without regard to accuracy, a rifled or a smooth-bore gun? This would depend altogether on what the equal conditions were. If each was loaded with a round ball of the same weight, the smooth bore would have the greatest range; but if each was loaded with a conical ball of the same weight (point foremost) the range would be greatly in favor of the rifle.—F. S. C. of Mass.

STEP FOR TURBINE WHEEL.—Let G. B. L. saw off the butt of a rock-maple stump, quarter it, and make the step endwise of the grain. Let him cut a slot across the step, and boil the block in tallow. This will make a step which will last a lifetime provided the bearing is large enough in proportion to the weight of the wheel. The heating of steps is generally the result of concentrating the friction upon too small a bearing surface.

QUARTER TIWST BELT.—J. F. K.'s quarter twist belt will work all right if it is put up right, and if the 10-inch belt has to pull hard enough to draw one edge more than the other, he can remedy it by placing an "idler pulley" on the drawing side to keep the belt hugging alike on both edges of the driven pulley. I would not make the distance between centers any less than he proposes—14·5 feet, but more if possible.—J. H., of N. Y.

MILL SAW GEARING.—J. B. W.'s sawmill will certainly perform well, geared in the manner he mentions. There were many such mills on the upper Alleghany river in 1833 and 1834, the best in the country working under from four to six feet head of water.—M. B., of Pa. [Several other correspondents concur in this opinion.—EDS.

SPEED OF MILLSTONES.—In answer to J. Y., I will give what I consider the proper speed for a 4-foot stone to grind from 6 to 10 bushels an hour of different kinds of grain, 160 revolutions a minute to grind corn, 180 on wheat, 150 on buckwheat, 160 to 180 on mixed grains for food, 160 for rye.—N. H. E.

HARNESS BLACKING.—Let N. L. M. take three sticks of black sealing wax, and dissolve them in half a pint of alcohol, and apply with a sponge. This varnish has the luster he wishes to obtain and will not injure the leather.—E. W. R., of N. J.

J. H. M., of L. I.—You can test a spirit level quite accurately with a plumb line and square in the way you describe provided the square is true. Wherever the middle of the bubble stands in the bottle when the instrument is thus leveled, is the true indication of the level. To bring the bubble to the middle of the bottle, the lower edge of the wood may be dressed off carefully with the plane. If the bubble is found to move to one side of the middle when the instrument is leveled with the square the standing of the bubble to the same distance on the other side of the middle would be indication of double the original error in the instrument, the level being considered correct only when the bubble stands at the middle, while the lower edge of the wood is on a horizontal line.

J., of N. Y.—If glycerin be allowed to fall drop by drop into a mixture of equal measures of nitric acid and oil of vitriol, care being taken not to let the temperature get too high, a heavy oily-looking liquid collects at the bottom which is nitro-glycerin. The reaction is the substitution of nitrous acid for hydrogen in the glycerin, the hydrogen combining with oxygen from the decomposed nitric acid to form water.

C. H. S.—The Fomicilban vacuum found by inverting a tube closed at one end and filled with mercury in a cup of the same metal, is not perfect. It contains always some vapor of mercury. Good authorities maintain that no perfect vacuum can be produced.

J. S., of Pa.—The syphon acts on the same principle as the atmospheric pump, and will raise water no higher than the pump, 33 feet, in round numbers, at sea level. The atmospheric pressure being overcome by the weight of the fluid in the longer leg, the same pressure forces the fluid up along the shorter leg.

O. J. F., of Mich.—The temperature of steam under a pressure of 30 pounds is 298 Fah., much below the temperature of repulsion spoken of in our article on "Boiler Explosions."

C. G. E., of La.—We think your preventive of explosions in coal oil lamps would be patentable. Its efficiency could only be determined by practical test.

C. B. R., of N. B.—We advise you to use a flue boiler set in mason work for a stationary engine, in preference to a locomotive boiler unset in brickwork.

A. G., of La.—We do not think the new antiseptic "chloralum" has been introduced into this country yet.

C. R. S., of Ohio.—The leverage of a crank varies with the direction in which the power is applied. Your question in its present form is unanswerable.

L. F., of N. J.—The colors on oil-cloth window shades are oil paints, applied either by a brush or printed on.

J. S., of R. I.—Siliceous silica is the flint of the chalk formations. We cannot tell you where it may be purchased.

## Business and Personal

*The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.*


The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4 00 a year. Advertisements 17c. a line.

Taft's Portable Hot Air, Vapor, and Shower Bathing Apparatus. Light, cheap, and convenient. Address Portable Bath Co., Sag Harbor, L. I., N.Y. (Send for Circular.)

For Sale, or to be disposed of on royalty.—The entire Right of the Patent Bird Swing advertised in another column. Address Thomas H. Bradley, Washington, D.C.

Parties having second-hand Blowing Engines for sale please address, stating capacity, age, and present employment of the machinery, L. W. Pond, 98 Liberty st.

Eureka! A water-wheel perpetual motion invented. It supplies itself and drives machinery. One-fourth interest for sale. Address A. T. Peck, Danbury, Conn.

The best place to get Working Models and parts is at T. B. Jeffery's, 106 South Water st., Chicago.

Glass Cutters' Wheels, by J. E. Mitchell, Philadelphia, Pa.

Saw Makers' Grindstones, by J. E. Mitchell, Philadelphia, Pa.

Edge Tool Makers' Grindstones, by J.E. Mitchell, Philadelphia.

Automatic Harvester Rake, easily attached to any Reaper in use. State and Shop Rights for sale. Address Stringer or Ward, Chatham, Ont.

Steel Stamp Alphabets, Figures, and Names. E. H. Payn, Burlington, Vt.

The Union Emery Wheel.—The Union Emery Wheel has been awarded the first prize at every Fair where it has been exhibited during the past year.

An Engineer wants a situation. L., Box 64, West Newton, Pa.

Peteler Portable R.R. Co., contractors, graders. See adv'ment.

Machine to Plait Corn Husks into a Horse-collar or a Foot-mat, wanted. Address Chris. Hogan, Knoxville, Tenn.

Substantial building, with steam power, and some capital ready, for some manufacturing enterprise. Address W. C. Williams, Chillicothe, Ohio.

Fine Pedespeed Skating without ice. See Illustration March 19, 1870. Order a pair with 16-inch wheels, $16, or 17-inch $17, at the works. Sent C.O.D. T. L. Luders, Olney, Ill.

Wanted—the address of Peters & Williams Clothes-line Holder. F. C. Gardner, Oneonta, N. Y.

Peck's Patent Drop Press. For circulars address the sole manufacturers, Milo, Peck & Co., New Haven, Ct.

Diamonds and Carbon turned and shaped for Philosophical and Mechanical purposes, also Glazier's Diamonds, manufactured and set by J. Dikenson, 64 Nassau st., New York.

Scale.—Allen's Patent will remove scale from steam boilers, and not injure the iron. Send for Circulars. Josiah J. Allen, Philadelphia.

Patent Floating Bridge, Floating Lighthouse, etc. For rights to build or use address Thomas Schofield, Grass Valley, California.

Building Felt (no tar) for inside and out. C. J. Fay, Camden, N.J.

Baxter's Portable Steam Engine. For descriptive Pamphlet address Russell & Speer, 10 Park Place, New York.

Patent Elliptic-geared Punches and Shears.—The greatest economy of power, space, and labor. Can be seen in operation at our factory, in Trenton, N. J. Address American Saw Co., 1 Ferry st., New York.

Hand Screw Punches and Lever Punches. American Saw Co., New York.

Self-testing Steam Gage—Will tell you if it is tampered with, or out of order. The only reliable gage. Send for circular. E. H. Ashcroft, Boston, Mass.

Glynn's Anti-Incrustator for Steam Boilers—The only reliable preventive. No foaming, and does not attack metals of boilers. Price 25 cents per lb. C. D. Fredricks, 307 Broadway, New York.

The Merriman Bolt Cutter—the best made. Send for circulars. Brown and Barnes, Fair Haven, Conn.

Pictures for the Drawing Room.—Prang's "Lake George," "West Point," "Joy of Autumn," "Prairie Flowers," Just issued. Sold in all Art Stores. "Three Tom Boys." "Bethoven," large and small.

Manufacturers and Patentees.—Agencies for the Pacific Coast wanted by Nathan Joseph & Co., 619 Washington st., San Francisco, who are already acting for several firms in the United States and Europe, to whom they can give references.

To Cure a Cough, Cold, or Sore Throat, use Brown's Bronchial Troches.

Machinery for two 500-ton propellers, 60-Horse Locomotive Boiler, nearly new, for sale by Wm. D. Andrews & Bro., 414 Water st., N.Y.

Lighting Gas in Streets, Factories, etc., with Bartlett's Patent Torch saves great expense, all risks, etc. It is being adopted everywhere. Address J. W. Bartlett, 509, Broadway, New York.

Keuffel & Esser 116 Fulton st., N.Y., the best place to get 1st-class Drawing Materals, Swiss Instruments, and Rubber Triangles and Curves

Cold Rolled-Shafting, piston rods, pump rods, Collins pat. double compression couplings, manufactured by Jones & Laughlins, Pittsburgh, Pa.

For mining, wrecking, pumping, drainage, and irrigating machinery, see advertisement of Andrews' Patents in another column.

House Planning.—Geo. J. Colby, Waterbury, Vt., offers information of value to all in planning a House. Send him your address!

A very Valuable Patent for sale, the merits of which will be appreciated at sight. Apply to or address Jewell & Ehles, 98 Liberty st., N.Y.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for Lithograph, etc.

Improved Foot Lathes. Many a reader of this paper has one of them. Catalogue free. N. H. Baldwin, Laconia, N. H.

Belting that is Belting.—Always send for the Best Philadelphia Oak-Tanned, to C. W. Arny, Manufacturer, 301 Cherry st., Phil'a.

For Fruit-Can Tools, Presses, Dies for all Metals, apply to Bliss & Williams, successor to May & Bliss, 118, 120, and 122 Plymouth st., Brooklyn, N.Y. Send for catalogue.

The Best Hand Shears and Punches for metal work, as well as the latest improved lathes, and other machinists' tools, from entirely new patterns, are manufactured by L. W. Pond, Worcester, Mass. Office 98 Liberty st., New York.

To Ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's Manufacturing News of the United States. Terms $4 00 a year.


## Recent American and Foreign Patents.

*Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.*

CUTTER FOR PLOWS.—G. F. Pyklet, Fairfield, Ill.—This invention has for its object to furnish an improved cutter for plows which shall be so constructed as to make the operation of plowing easier for man, team, and plow; which will ride over roots and rocks, and take the ground again as soon as the obstruction has been passed, and which, by running under and separating the trash that may be upon the ground, will keep the plow clean.

MEDICAL COMPOUND.—Michael O'Reilly.—New York city.—The object of this invention is to condense cod liver oil, and improve its taste, so that it would become palatable without having its therapeutic qualities in the least impaired. The invention consists in the production of a cod-liver-oil butter; that is to say, in combining the oil with concrete or buteraceous fat. Thereby the medical fat is brought into a form in which it can be conveniently prepared for the palate, either by using it as butter on bread or other substance, or by making it up into pills or otherwise.

SISAL GRASS MACHINE.—G. E. Hopkins and W. B. Shedd, Boston, Mass.—This invention has for its object to furnish a simple, convenient, and effective machine for crushing, scraping, and cleaning the leaves or stalks of the *Agave Americana*, or American aloe, better known as sisal grass or sisal hemp, and for cleaning the reah or China grass, and other fibrous leaves, and which shall be so constructed as to clean the fiber perfectly and lay it straight ready for baling.

COMBINED SHELF BRACKET AND CLOTHES HOOK.—H. E. Hutchinson, South Brooklyn, N. Y.—This invention has for its object to furnish an improved bracket for use in clothes closets and other places, which shall be so constructed as to support a shelf, and at the same time serve as hooks for hanging clothes, and which shall economise space by allowing a greater quantity of clothes to be hung upon them than can be hung in the same space when the ordinary clothes hooks are used.

AUTOMATIC BAND CUTTER, SPREADER, AND FEEDER.—W. H. H. Youngs, Waverly, Iowa.—This invention has for its object to furnish an improved band cutter and feeder for attachment to thrashing machines, which shall be so constructed as to receive the bundles, cut the bands, spread the grain evenly, and deliver it to the thrashing machine, thus saving labor and expense, and doing the work better than it could be done by hand.

CIGAR MACHINE.—Robert Neisch, Allentown, Pa.—This invention relates to a new machine for rolling cigars into the proper shape, applying the binders and wrappers, or the latter only, thereto, forming the points or heads, and cutting the wrappers. The invention consists chiefly in cutting the wrappers for the points or ends of the cigars while the same are being rolled. Heretofore cigar machines were so constructed as to require the wrappers ready cut for application. As the material from which wrappers are made is the most valuable portion of the cigar, and consequently cut as economically as possible, it will frequently happen that when the same is not applied with great exactness, the cut wrapper will fail to cover the entire cigar, and another piece will have to be used, thus converting intended economy into absolute waste. By cutting the wrapper by automatic machinery, after the same has already been partly applied to the cigar, the greatest exactness and most perfect fit will be obtained.

DOUBLETREE FASTENER.—Decatur Werst, South Bend, Ind.—This invention relates to a new casting for uniting whiffletrees to doubletrees to shears, and also for securing doubletrees to tongues. The invention consists in the use of a double ring-shaped casting, which is adapted to embrace both pieces to be united, and to secure the same by means of one single pin.

AUTOMATIC BARREL FILLER.—S. C. Catlin, Cleveland, Ohio.—The object of this invention is to provide ready and efficient means for automatically stopping the flow of the liquid into a barrel or vessel, when such vessel or barrel is filled or nearly filled, and it consists in certain mechanical devices arranged to operate as hereinafter more fully described, and also in a device in combination with the above for drawing liquids from the reservoir for testing or other purposes.

CAR SEAT BACK LOCKS.—Adam Leofelholz and Anton Prier, Milwaukee, Wis.—This invention relates to improvements in car-seat back locks, and consists in a sliding spring catch bolt applied to the arm of the seat back and arranged in connection with the bracket on the end of the seat on which the arm rests, which bracket is provided with a notch below a projecting hook on one edge, so that when the arm goes down to its seat, the sliding bolt will be drawn back, by the projection, against the action of a spring which draws it round again under the projection as the arm moves in its seat, and holds the bolt until unlocked by a key inserted through a projecting case fitted on the bolt and spring. The invention also comprises the arrangement of the bolt and spring with the case and the cam spindle by which the said bolt is turned.

HOISTING APPARATUS.—H. H. Hunt, Saratoga Springs, N. Y.—This invention relates to improvements in a hoisting apparatus for hoisting building material to be used in the erection of new buildings, and it consists in a combination with endless chains hooking over octagonal rollers and provided with suitable driving gear for working them either by hand or steam power, of reversible holding bails adapted for holding the hods containing the material to be elevated either on the ascending or descending side. It also consists in a combination with the driving machinery for the chains, of a winding drum for operating a rope to hoist such heavy material as cannot be taken in the hods, the whole apparatus being arranged on a portable frame adapted to be placed on the outside of the building, and designed to be made extensible vertically.

CULTIVATOR.—P. E. Smith, Scotland Neck, N. C.—This invention has for its object to furnish a simple, convenient, and effective cultivator, which shall be so constructed that the wheels may be readily moved closer together or farther apart to adjust the machine to the different widths of cotton and corn rows; that the plows may be readily moved closer together or further apart, to adjust the machine to work closer to or further from the rows of plants; and that the plows may be readily raised from the ground and held as long as may be desired.

FUSE FOR RIFLE SHELLS.—James Eggo, Jersey City, N. J.—This invention has for its object to furnish an improved fuse for rifle shells which shall be so constructed as to insure certainty of explosion and entire safety in transportation and handling, and which shall at the same time be simple in construction and manufacture.

FENCE POST.—R. M. Filson, Willsborough, N. Y.—This invention relates to a new fence post which is made with a view towards durability and cheapness. The post is made of stone, and provided with a U-shaped iron rail at one side by which the fence rails are held against it, they being supported by eye bolts projecting from the post.

FENCE.—William D. Hillis, Elgin, Ill.—This invention relates to an improvement on the fence patented to the same party in April, 1866, and consists mainly in the improved manner of securing the wires, and bracing or supporting them, whereby the fence is made stronger, cheaper, and more durable, and is more easily put up or taken down.

THERMOMETER.—John D. Ward, Baltimore, Md.—This invention consists of the combination of a thermometer with two plates, one inscribed with the ordinary Fahrenheit centigrade, or Reaumur scale, and the other inscribed with with a scale showing, in this instance, four different temperatures of water, and intended for use in baths, said plate also bearing a scale which shows the best temperature for fermenting and malting, also the degree of heat in cream best adapted to the production of butter, and the degree of heat in whey best adapted to the production of cheese.

PEW SHELF.—David Buchanan, Philadelphia, Pa.—This invention relates to the application to church pews and other seats of public assembly rooms of shelves for holding the hats, cloaks, and other articles of the occupants' and it consists in the arrangement on the rear side of the front support of the seat and under the latter of hinged or pivoted shelves so constructed that they may be readily thrown into the horizontal position and maintained there, for use and be thrown up again and secured by a spring catch when not wanted for use, and to facilitate sweeping and cleaning the floor under them.

STEAM GENERATOR.—George W. Shields, Louisville, Ky.—This invention relates to certain improvements of construction and detail in that class of steam generators in which the feed water, prior or subsequent to entering the boiler, is conducted through pipes that traverse the furnace chamber where, when a fire is built, said pipes and the water therein are heated by caloric that would otherwise be wasted and a more speedy generation of steam ensues.

"CHAMBER."—Vernon Rhodes, Memphis, Tenn.—This invention relates to an improvement in chamber-pots for the sick room, and consists in dividing them into two separate compartments for the purpose of separating the urine from the feces in order that it may be inspected by physicians.

SELF-ACTING CAR COUPLING.—James C. Morris, Greenville, Tenn.—This invention consists of spring hooks pivoted at their extremities in a drawhead, in combination with a bolt triangular in cross section passing vertically through a complementary draw head, which retains the hooks after they have entered the drawhead in which is the triangular bolt, and have passed one to side of the same and closed together again at its rear, said bolt having a V-shaped groove running lengthwise of its rear side, which receives the points of the hooks, holds them, and prevents them from lapping.

REVOLVING CANNON.—Edward Brehm, Hudson, N. J.—This invention has for its object to construct a revolving fire-arm or cannon of such destructiveness and power, that by reason of its vast degree of effectiveness the danger of resort to armed conflicts will be materially reduced.

TABLES.—George G. Congle, Chippewa Falls, Wis.—This invention relates to improvement in mode of constructing tables, the object being to not only reduce expense of construction, but to enable them to be taken apart for transportation or storing away.

WATER FILTER.—J. W. Dougherty, Chicago, Ill.—This invention relates to improvements in that class of water filters which are designed for attachment to the water supply pipes to filter the water as it is drawn therefrom.

THIEF AND LIQUID MEASURE.—Seth C. Catlin, Cleveland, Ohio.—The object of this invention is to furnish an instrument for taking liquids from barrels, or other vessels, for samples and for measuring the same, so that much time and trouble may be saved, and it consists in a hollow globe or sphere provided with a valve chamber and valve, and with a graduated and adjustable induction tube and delivery cock.

COMBINED FOOT-REST AND BOOT-JACK.—D. K. James, Cincinnati, Ohio.—This invention consists in an adjustable stand with a hinged bracket for supporting the feet, with which is combined a boot-jack, the design being to afford convenient means for resting weary limbs.

HOOP-RACKING MACHINE.—R. M. Shaner, Genoa, Ohio.—This invention relates to improvements in machines for "racking" hoops, and consists in an arrangement with a channeled bench and a pushing apparatus for forcing the pieces of timber along the channel of an inclined plane, a fixed racking roller and a vertically movable roller arranged to be forced down upon the piece of timber to be racked as it is forced between the rollers and up the incline, so that it is subjected to an abrupt bending at all points from end to end by which the layers are racked apart.

SEWING MACHINE.—Lebeus W. Lathrop, Poughkeepsie, N. Y.—This invention consists in an improved combination and arrangement of means for passing the spool through the loop. The invention also consists in a combination with the needle and the said loop spreader, of a looper and operating devices therefor for forming a chain stitch with one thread (the lower one not being used), under such an arrangement that the said looper may also be used in conjunction with the devices for making a lock-stich, and thereby produce a compound lock and chain stich. The invention also consists in a novel arrangement of the driving gear for operating the lower spool and the looper, for shifting the same relatively to the needle driving gear, whereby the machine may be worked by turning the driving gear either way, and the feed changed to either direction by simply changing the direction of the motion of the drawing gear. The invention also consists in certain other improved combinations and arrangements of operating devices.

TABLE TOPS.—Isaac N. Swasey, Yonkers, N. Y.—The object of this invention is to secure the tops of billiard and other tables, and other wood surfaces, in such a manner that they shall be prevented from warping, winding, and twisting, from atmospheric changes of moisture or temperature, or from other causes.

CULTIVATOR.—Isaac B. Mahon, Dunkirk, Ohio.—This invention has for its object to furnish an improved cultivator, which shall be so constructed that the plow beams may have a free lateral movement for convenience in cultivating crooked rows, or avoiding irregular hills, and which shall at the same time be strong and durable.

VINEGAR APPARATUS.—Theodore Grundman, Cincinnati, Ohio.—The object of this invention is to avoid the use of braided straw or other fabric, and to permit the employment of plain straw cane, branches, or other simple material.

CLOTHES PIN.—William Miller, Boston, Mass.—This invention relates to a new and useful improvement in pins for holding clothes on lines for drying and consists in connecting two wooden jaws by a metallic coil spring.

LUBRICATOR.—J. L. Dickinson, Dubuque, Iowa.—The object of this invention is to provide suitable and convenient means for introducing oil or other lubricating material into steam cylinders and other places under pressure of steam or other fluid.

HYDRAULIC MINING APPARATUS.—Frank R. Fisher, Nevada City, Cal.—This invention relates to a new apparatus for discharging water against hills and mountains for mining purposes, and has for its object to permit the directing of the discharge nozzle to any suitable hight or at any suitable angle, horizontally and vertically. The proper washing of the surface can thus be produced without great exertion or difficulty.

STEAM GENERATING AND DISTILLING APPARATUS.—Solomon Sowards and Morris Wood, Chillicothe, Ill.—This invention relates to a new and useful improvement in an apparatus for generating steam for cooking food or other purposes, where steam at low pressure only is required, and also for distilling purposes.

BALANCE FOR SHAFTING, CYLINDERS, ETC.—Henry Martinson, Hawksville, Ind.—This invention has for its object so to hang and balance shafting, drums, cylinders, and other rotary machinery, that the same may be properly tested while running, to ascertain whether the center of gravity is properly distributed along their axis. The chief difficulty hitherto experienced in balancing cylindrical rotary bodies, consists in the disproportionate inequality at the opposite ends of the cylinder, the balancing of one end, leaving the other end, and thereby the entire body is usually as inaccurate as though not at all balanced. This invention overcomes this difficulty by providing for the simultaneous balancing of both ends, and thereby the entire body of the cylinder.

VEHICLE.—Charles Daniel, Brownsville, Mo.—This invention has for its object to furnish an improved device for attachment to spring wagons, buggies, and other vehicles, to prevent the pitching forward of the vehicle and the consequent strain, jamming, or breakage of the springs or couplings.

COMBINED COTTON-PLANTER, GUANO-DISTRIBUTOR, CHOPPER, AND CULTIVATOR.—John E. Ross, Greensborough, Ga.—This invention has for its object to furnish an improved machine which may be easily adjusted for use as a cotton-seed planter, guano distributor, cotton chopper, and cultivator, and which will be reliable in use and effective in operation in either capacity.

RHEUMATIC LINIMENT.—Archibald A. Biddick, Franklin, Va.—This invention has for its object to furnish an improved liniment for the cure of rheumatism in all its forms, pains, sprains, bruises, neuralgia, paralysis, mumps, diphtheria, sore throat, corns, bunions, etc., and which will give instant relief in all cases.

COMBINED COTTON-SEED AND CORN PLANTER.—J. A. Towers, Quincy, Fla.—This invention has for its object to furnish an improved planter which shall be simple in construction and effective in operation, and which may be readily adjusted for planting the linty seeds of short staple cotton, or for planting black cotton seed, corn, peas, or other smooth seeds.

GRAIN SCOURER.—Austin Smith, Valmont, Col. Ter.—This invention has for its object to furnish a simple, convenient, inexpensive, and effective machine for cleaning and scouring wheat for grinding.

FANNING MILL.—Frank Sauers and John C. Coerver, Waterloo, Ill.—This invention relates to improvements in fanning mills, and consists in an improved combination and arrangement of the several parts.

PLANTER AND CULTIVATOR.—Solomon Bacter, Edena, Mo.—This invention relates to improvements in machines for planting and cultivating, and consists in the application to a self dropping apparatus of drag covering devices, also of cultivators which are to be used in such ground that the drags will not cover the corn, the said cultivators being detachable. The invention also comprises improvements in the arrangement of the dropper slide, and the actuating devices therefor.

CULTIVATOR.—Isaac B. Mahon, Dunkirk, Ohio.—This invention has for its object to improve the construction of the improved cultivator patented by the same inventor Jan. 29, 1857, Sept. 17, 1867, and March 24, 1868, so as to make it more strong and durable, and at the same time more economical in construction.

SAND-HOLDER FOR CASTING HOOK-SHAPED STRAPS.—John Herald, Unadilla, N. Y.—The object of this invention is to provide a rigid or stable mold, which can be inserted between the spaces intended for the casting of the main body or shank of a strap or plate and the turned-over ear or hook of the same. The invention consists in the use for the stated purpose of a metallic case or sand-holder, in which the sand for the mold is contained.

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## Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

PROVISIONAL PROTECTION FOR SIX MONTHS.

2,115.—MEANS FOR PREVENTING THE FRAUDULENT USE OF BONDS, RECEIPTS, CHECKS, TICKETS, AND OTHER LIKE ARTICLES.—T. R. Hayes and C. R. Peters, San Francisco, Cal. July 29, 1870.

2,829.—SPRINGS FOR RAILWAY CARRIAGES.—Richard Vose, New York city. October 27, 1870.

2,857.—SPIRAL PUMPS.—T. Schoenberger Blair, Pittsburgh, Pa. October 31, 1870.

2,859.—ORE-WASHING MACHINES.—Hezekiah Bradford, Reading, Pa. Oct. 31, 1870.

2,860.—PROTECTING TROOPS UNDER FIRE.—W. S. Wetmore, New York city. October 31, 1870.

2,863.—SILICIOUS COMPOUND, APPLICABLE FOR THE MANUFACTURE OF PIPES, TILES, BRICKS, AND OTHER ARTICLES FOR BUILDINGS, ALSO FOR PATHS, FLOORS, ROOFS, AND OTHER ANALOGOUS PURPOSES.—William Augustus Battersby, Brooklyn, Timothy Reed Crawford, New York city, and R. Brown, Brooklyn, N. Y. October 31, 1870.

2,879.—BOXES AND BEARINGS FOR AXLES AND OTHER SHAFTS, AND IN COMPOSITIONS TO BE APPLIED THERETO.—Eliza D. Murfey, New York city. November 1, 1870.

2,899.—MACHINERY FOR POINTING NAILS.—Lawrence Barnes, Burlington, N. J. November 3, 1870.

2,900.—CUTTING, BORING, GRINDING, AND PULVERIZING STONE AND OTHER HARD SUBSTANCES.—Benjamin Chew Tilghman, Philadelphia, Pa. November 3, 1870.

## Official List of Patents.

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110,187.—PLANTER AND CULTIVATOR.—Solomon Bacher, Edina, Mo.
110,188.—LAMP-WICK.—Philander Baker, Chicago, Ill.
110,189.—PACKING CAUSTIC ALKALIES.—William Henry Balmain, St. Helen's, Great Britain, assignor to the Greenbank Alkali Company, and said Company assignor to George T. Lewis, Philadelphia, Pa.
110,190.—APPARATUS FOR GENERATING CARBONIC ACID.—Wallace H. Bate, East Somerville, Mass.
110,191.—SMUT-MILL.—J. Adam Benzing, Jr., Oswego, N. Y.
110,192.—CANE-JUICE EVAPORATOR.—John S. Blymyer, Mansfield, Ohio. Antedated December 17, 1870.
110,193.—APPARATUS FOR PITCHING BARRELS.—James W. Brady, Baltimore, Md.
110,194.—REVOLVING CANNON.—Eduard Brehm, Jersey City, N. J.
110,195.—SEAL-LOCK.—Benjamin Briscoe, Detroit, Mich.
110,196.—FANNING-MILL.—Levi Bronson (assignor to James Braley), Buffalo, N. Y.
110,197.—PEW-SHELF.—David Buchanan, Philadelphia, Pa.
110,198.—VISE.—Isaiah Byrd and Turner Byrd, Jr., Calvin township, Mich.
110,199.—IMPLEMENT.—Joseph W. Calef (assignor to himself, Harvey King, and Augustus Peabody Hutchinson), Boston, Mass.
110,200.—CLEVIS.—David M. Castle, Constantine, Mich.
110,201.—BARREL-FILLER.—Seth C. Catlin, Cleveland, Ohio. Antedated December 17, 1870.
110,202.—LIQUOR-THIEF AND MEASURE.—Seth C. Catlin, Cleveland, Ohio. Antedated December 16, 1870.
110,203.—KITCHEN AND HOUSEHOLD SINK.—Ernest George Chormann and Edward McLaughlin, Philadelphia, Pa.
110,204.—CAR AND OTHER SPRINGS.—John W. Cochran, New York City.
110,205.—EJECTOR.—Hugh Coll, Millvale Borough, Pa.
110,206.—GALVANIC BATTERY.—Daniel McFarland Cook, Mansfield, Ohio.
110,207.—CORN-PLANTER.—Richard B. Corson and Henry Corson, Henry Co., Mo.
110,208.—STOPPING-MECHANISM FOR LOOMS.—James Cowngill, Philadelphia, Pa.
110,209.—VEHICLE.—Charles Daniel, Brownsville, Mo.
110,210.—POWDER-FLASK.—Franklin E. Darrow (assignor to Darrow Manufacturing Company), Bristol, Conn. Antedated December 17, 1870.
110,211.—TRANSPLANTING IMPLEMENT.—Asahel Davis, Lowell, Mass. Antedated December 14, 1870.
110,212.—MOTIVE-POWER APPARATUS.—Thomas Davis, Detroit Mich.
110,213.—SECTIONAL IMAGE.—Benjamin Day, West Hoboken, N. J.
110,214.—CAR-COUPLING.—John C. Dearborn, Candia, N. H.
110,215.—LUBRICATOR.—Joseph L. Dickinson, Dubuque, Iowa.
110,216.—PORTABLE LOADING AND DUMPING-MACHINE.—William D. Dorsey, Decatur, Ill.
110,217.—WATER-FILTER.—Joseph W. Dougherty, Chicago, Ill.
110,218.—MACHINE FOR BEAMING YARNS OR WARPS.—George Draper, Hopedale, Mass.
110,219.—SHELL-FUSE.—James Eggo, Jersey City, N. J.
110,220.—EXTENSION TABLE.—Thomas C. Ellison, Albany, N. Y.
110,221.—FENCE-POST.—Robert M. Filson, Willsborough, N. Y.
110,222.—HYDRAULIC MINING APPARATUS.—Frank H. Fisher, Nevada City, Cal.
110,223.—CUT-OFF VALVE-GEAR.—George W. Fisher and Hugh Reid (assignors to Gerard B. Allen & Co., and Hugh Reid), St. Louis, Mo.
110,224.—HAY-ELEVATOR.—Robert Furnas, Friendswood, Ind.
110,225.—WARPING-MACHINE.—Jacob Furrer, New York city. Antedated Dec. 9, 1870.
110,226.—HAMES-FASTENER.—Anthony Gale and Henry R. Johnson, Shelby county, Ky.
110,227.—STAMP-CANCELER.—John Goldsborough, Philadelphia, Pa.
110,228.—TOY GUN.—John Goodale, Boston, Mass. Antedated December 9, 1870.
110,229.—APPARATUS FOR THE MANUFACTURE OF VINEGAR.—Theodore Grundmann, Cincinnati, Ohio.
110,230.—COOKING-STOVE.—William Hailes, Albany, N. Y.
110,231.—TUMBLER-WASHER.—Albert Hallowell (assignor to Gustavus D. Dows, Calvin Dows, and George S. Cushing), Lowell, Mass.
110,232.—BARREL.—Thomas Hanvey, Elma, N. Y.
110,233.—REPEATING CANNON.—James H. Hedrick (assignor of one-third his right to J. B. Barrett), Wythe county, Va.
110,234.—FENCE.—William D. Hillis, Elgin, Ill.
110,235.—WASHING-MACHINE.—Alexander Hilton, Strathroy, Canada.
110,236.—SAW-MILL.—Jacob R. Hoffman, Fort Wayne, Ind.
110,237.—MACHINE FOR PREPARING FIBERS FROM SISAL-GRASS AND LIKE SUBSTANCES.—George E. Hopkins and William B. Shedd, Boston, Mass.
110,238.—HOISTING APPARATUS.—Henry H. Hunt, Saratoga, Springs, N. Y.
110,239.—SHELF BRACKET AND CLOTHES HOOK.—Henry E. Hutchinson, South Brooklyn, N. Y.
110,240.—FOOT REST AND BOOTJACK COMBINED.—David H. James, Cincinnati, Ohio.
110,241.—LAMP BURNER.—Walter Proctor Jenney and George Washington Taylor, Fairhaven, Mass. Antedated Dec. 15, 1870.
110,242.—HOODED GARMENTS.—Ambrose Keating (assignor to Benjamin T. Stephenson), Boston, Mass.
110,243.—TOOL FOR FORMING MOUTHS OF GLASS JARS.—Gov-eneur M. Keeffer (assignor to himself and William H. Barry), Birmingham, Pa.
110,244.—PRINTING PRESS.—John W. Kellberg, Philadelphia, Pa.
110,245.—BLOTTING PAD.—Augustus Burr Kellogg, Buffalo, N. Y.
110,246.—HARVESTER DROPPER.—Thomas W. S. Kidd, Springfield, Ill.
110,247.—MODE OF BALANCING CYLINDERS, PULLEYS, ETC.—William Kitson, Lowell, Mass.
110,248.—SASH HOLDER.—Andrew J. Kramer, Marion, Iowa.
110,249.—CLAY RETORT FOR THE MANUFACTURE OF GAS.—Frederick C. Krause (assignor to Samuel A. Walsh), New York city.
110,250.—SEWING MACHINE.—Lebbeus W. Lathrop, Poughkeepsie, N. Y.
110,251.—ADJUSTLABLE PLOW JOINTER.—John M. Leonard, Marshall City, Mich.
110,252.—MACHINE FOR FILLING OR STARCHING WOVEN FABRICS.—Thomas Lewis Livsey, Bury, Great Britain.
110,253.—HOSE COUPLING.—Conrad Locher (assignor to himself and George C. Perkins), Oroville, Cal.
110,254.—CAR SEAT LOCK.—Adam Lœffelholz and Anton Prier, Milwaukee, Wis.
110,255.—TIGHTENING STRAP FOR BARRELS.—Samuel Macferran, Philadelphia, Pa.
110,256.—CULTIVATOR.—Isaac B. Mahon, Dunkirk, Ohio.
110,257.—CULTIVATOR.—Isaac B. Mahon, Dunkirk, Ohio. Antedated Dec. 15, 1870.
110,258.—BASE-BURNING STOVE.—Henry C. March, Limerick Station, Pa.
110,259.—MODE OF BALANCING SHAFTS.—Henry Martinson, Hawksville, Canada.
110,260.—FLIER FOR SPINNING.—Thomas Mayor, Providence, R. I.
110,261.—PLATFORM WEIGHING SCALES.—Richard J. McKeone, Inverness, Mich.
110,262.—MACHINE FOR BENDING WOOD.—John McMichael (assignor to Wright Brothers & Co.), Philadelphia, Pa.
110,263.—CLOTHES PIN.—William Miller, Boston, Mass.
110,264.—CARTRIDGE.—Richard R. Moffatt, Brooklyn, N. Y.
110,265.—METALLIC CARTRIDGE.—Richard R. Moffat, Brooklyn, N. Y.
110,266.—PERCUSSION PRIMER FOR CARTRIDGES.—Richard R. Moffatt, Brooklyn, N. Y.
110,267.—BOBBIN-WINDING AND NEEDLE-SHARPENING ATTACHMENT FOR SEWING MACHINES.—Richard R. Moffatt, Brooklyn, N. Y.
110,268.—MODE OF APPLYING MOTIVE POWER TO MACHINERY.—Richard R. Moffatt, Brooklyn, N. Y.
110,269.—CAR COUPLING.—James C. Morris, Greeneville, Tenn.
110,270.—MACHINE FOR MAKING CIGARS.—Robert Neisch, Allentown, Pa.
110,271.—STAVE JOINTER.—John Newman, Cleveland, Ohio, administrator of the estate of Samuel Newman, deceased.
110,272.—MUSIC STAND.—James Newton, Hanover, N. H.
110,273.—CORSET CLASP AND SPRING.—Peter H. Niles, Boston, Mass. Antedated Dec. 9, 1870.
110,274.—FURNACE STOVE.—James Old, Pittsburgh, Pa.
110,275.—PREPARATION OF COD-LIVER OIL.—Michael O'Reilly, New York city.
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110,277.—MANUFACTURE OF COLORS AND THEIR APPLICATION TO FABRICS.—Alfred Paraf (assignor to Edward S. Renwick, trustee), New York city.
110,278.—COTTON PRESS.—Isaac N. Patten and Eli W. Long, Shelby county, Tenn.
110,279.—HARVESTER RAKE.—Henry Pease (assignor to himself and Henry W. Seymour), Brockport, N. Y.
110,280.—ROCK DRILL.—Charles Peck (assignor to himself and Milo Peck), New Haven, Conn.
110,281.—GANG PLOW.—Thomas Pepler, Hightstown, N. J.
110,282.—COOKING STOVE.—Joseph Pratt and James H. Wentworth, Boston, Mass.
110,283.—CUTTER FOR PLOWS.—G. F. Pykiet, Fairfield, Ill.
110,284.—SPRING BED BOTTOM.—James Henry Quackenbush, Laddington, Mich.
110,285.—BOOT-CRIMPING MACHINE.—John Rausch, Huntington, Ind. Antedated Dec. 9, 1870.
110,286.—CHAMBER VESSEL.—Vernon Rhoades, Memphis, Tenn.
110,287.—CONSTRUCTION OF ORNAMENTAL-HEADED PICTURE NAILS.—Thomas C. Richards, New York city.
110,288.—LINIMENT FOR THE CURE FOR RHEUMATISM.—Archibald A. Riddick, Franklin, Va.
110,289.—INJECTOR.—C. F. Root. West Springfield, Mass.
110,290.—COMBINED COTTON PLANTER AND GUANO DISTRIBUTER.—John E. Ross, Greensborough, Ga.
110,291.—FANNING MILL.—Frank Sauer and John Coerver, Waterloo, Ill.
110,292.—FAUCET.—Matthew Scrannage, Medfork, and W. H. Bate, East Somerville, Mass.
110,293.—SPRINGS FOR BEDS, SOFAS, ETC.—John Sears, Cortlandt, N. Y.
110,294.—VALVE FOR ENGINES.—William C. Selden, Brooklyn, N. Y., assignor to Adam Carr, Paterson, N. J.
110,295.—HOOP-RACKING MACHINE.—Russel M. Shaner, Genoa, Ohio.
110,296.—CHURN.—John Shappell, Lynnville, Pa.
110,297.—PUMP.—Nathaniel P. Sheldon, San Francisco, Cal. Antedated Dec. 16, 1870.
110,298.—STEAM GENERATOR.—George W. Shields, Louisville, Ky.
110,299.—PRESS FOR FORMING SOLES FOR PACKS.—Warren G. Slater, Hart, Mich.
110,300.—SLIDE VALVE.—James Smart, Stratford, England.
110,301.—GRAIN SCOURER.—Austin Smith, Valmont, Colorado Territory.
110,302.—CULTIVATOR.—Peter E. Smith, Scotland Neck, N. C.
110,303.—TYPE-CASTING MACHINE.—William Spang, Philadelphia, Pa.
110,304.—COTTON PRESS.—Noah W. Speers, Memphis, Tenn. Antedated Dec. 8, 1870.
110,305.—COOKING STOVE.—David Stuart and Lewis Bridge (assignor to David Stuart and Richard Peterson), Philadelphia, Pa.
110,306.—BILLIARD TABLE.—Isaac N. Swasey, Yonkers, N. Y.
110,307.—MOLD FOR CASTING UNDER PRESSURE.—John Blake Tarr, Fairhaven, Mass.
110,308.—LAMP CHIMNEY.—George W. Taylor and Walter P. Jenney, Fairhaven, Mass. Antedated Dec. 8, 1870.
110,309.—CANT HOOK.—Waldy Tetro, Northampton, Mass., assignor to Union Nut Co., Unionville, Conn.
110,310.—PAD FOR CORSETS.—Mary P. R. Tilton, Trenton, N. J.
110,311.—COTTON SEED AND CORN PLANTER.—I. A. Towers, Quincy, Fla.
110,312.—HEATING STOVE.—Alvah Traver, Troy, N. Y.
110,313.—BOILER FURNACE.—Thomas Vickars, Sr., Thomas Jr., and James Smith, Liverpool, Eng.
110,314.—THERMOMETER.—John D. Ward, Baltimore, Md., assignor to himself and W. F. Jones.
110,315.—SPARK ARRESTER.—Jason Weidman, John Major and John J. Sample, Pittsburgh, Pa.
110,316.—ADJUSTABLE SQUARE.—Samuel F. Wesner (assignor to himself and James Foster, Jr.), Camden, N. J.
110,317.—LEACHES FOR TANNING.—William T. H. Wharton Fayetteville, Tenn.
110,318.—FEEDING MECHANISM FOR COTTON OPENERS, ETC.—W. E. Whitehead, Miles Platting, England.
110,319.—PUMP BOX.—Anthony S. Whitehouse (assignor to himself and E. W. Southworth), Ashland, Mass.
110,320.—HORSE-POWER.—John W. Wilcox (assignor to himself and John S. Schofield), Macon, Ga.
110,321.—STEAM GENERATING APPARATUS.—Morris Wood, Chillicothe, Ill.
110,322.—FRUIT PARER.—L. S. Woodburn (assignor to himself and David F. Hunt), South Antrim, N. H.
110,323.—ANTI-FRICTION JOURNAL.—P. W. Yarrell, Littleton, N. C.
110,324.—AUTOMATIC BAND CUTTER, SPREADER, AND FEEDER.—W. H. H. Youngs, Waverly, Iowa.
110,325.—SOCKET FOR BROOM HANDLES.—Henry Achew, Cincinnati, Ohio.
110,326.—TWINE HOLDER.—John Adt, New Haven, Conn.
110,327.—COMBINED LINT ROOM AND COTTON PRESS.—I. H. Albertson, Bedias, Texas.
110,328.—REVOLVING REFRIGERATOR.—Frank Allen, Erie, Pa.
110,329.—GRAPNEL.—N. P. Allen and N. E. Allen, Salem, Mass. Antedated Dec. 7, 1870.
110,330.—ROTARY PUMP.—William D. Andrews, Brookhaven, N. Y.
110,331.—HOISTING APPARATUS.—W. D. Andrews, Brookhaven, N. Y.
110,332.—BEEHIVE.—Roberson Arnold, Suffolk, Va.
110,333.—COMBINED LAND ROLLER AND MARKER.—Henry F Baker, Centreville, Ind.
110,234.—DRAFT COCK.—Wallace H. Bate, East Somerville, Mass.
110,335.—SEWING MACHINE TABLE.—Joseph Bennor (assignor to himself, John N. McLean, and Samuel Crawford), Philadelphia, Pa.
110,336.—PLOW.—James O. Billing, Halcyon Dale, Ga.
110,337.—CORPSE-PRESERVING COFFIN.—James Y. Black, Cleveland, Ohio.
110,338.—FEEDER FOR REPEATING FIRE-ARMS.—Lewis Wells Broadwell, Carlsruhe, Grand Duchy of Baden.
110,339.—FARE REGISTERING APPARATUS.—Charles Alexander Calvert, Manchester, Kingdom of Great Britain.
110,340.—SAFETY CASE FOR FRUIT JARS.—Jane Carter, Towanda, Pa.
110,341.—CORN PLANTER.—J. T. Carter and M. B. William son, Xenia, Ill.
110,342.—PEN.—R. H. Chinn, Washington, D. C.
110,343.—ROOFING MATERIAL.—J. H. Cole, Chicago, Ill.
110,344.—HARROW.—D. B. Conover, New Bedford, N. J.
110,345.—COMPOUND FOR PURIFYING MINE WATER.—F. J. Delker, Ashland, Pa.
110,346.—HYDRAULIC PRESS.—J. A. Desgoffe, Paris, France. Antedated December 9, 1870.
110,347.—CLOTHES DRYER.—J. T. Elliott, Grand Rapids, Mich.
110,348.—MILK RECEPTACLE.—G. M. Fillmore, St. Paul, Minn.
110,349.—ROLL FOR FORMING HORSESHOE BLANKS.—C. L. Fitzhugh, Pittsburgh, Pa.
110,350.—ROTARY STEAM ENGINE.—G. S. Follensbee (assignor to himself and John Rosencrantz), Philadelphia, Pa.
110,351.—GRAIN SIEVE AND OAT EXTRACTOR.—Thomas Follett, Clermont, Iowa.
110,352.—OSCILLATING STEAM ENGINE.—I. N. Forrester, Bridgeport, Conn.
110,353.—BREECH-LOADING FIRE-ARM.—Stephen Gerngross, St. Louis, Mo.
110,354.—MACHINE FOR CUTTING SHEET METAL TO AN OVAL FORM.—W. D. Grimshaw, Newark, N. J.
110,355.—EXPLOSIVE COMPOUND.—Joseph Hafenegger, San Francisco, Cal.
110,356.—GANG PLOW.—James Harris, San Francisco, Cal.
110,357.—MOUSE TRAP.—H. C. Hart, Unionville, Conn.
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110,363.—GATE.—H. R. Hoskins, Harlan, Ind.
110,364.—PURIFYING OILS WHICH HAVE BEEN USED IN LUBRICATING MACHINERY.—Christopher Houlker, Frankford, Pa.
110,365.—SASH SUPPORTER.—R. B. Hugunin, New York city.
110,366.—UTILIZING SEWERAGE MATTER.—J. B. Hyde, New York city.
110,367.—THILL COUPLING.—F. A. Jewett, Grafton, Mass.
110,368.—MACHINE FOR OPENING COTTON.—W. C. Jillson and A. B. Palmer, Willimantic, Conn.
110,369.—ROLLING MILL.—J. H. Jones, Knoxville, Tenn.
110,370.—TRUSS AND SUPPORTER.—Nathaniel Jones, New York city.
110,371.—ROLLED BAR FOR PLOW-BEAM BLANKS.—G. W Jope and William Bunton, Pittsburgh, Pa.
110,372.—MACHINE FOR MAKING POST-HOLES.—J. M. Kirkpatrick, Utica, Ohio. Antedated December 15, 1870.
110,373.—APPARATUS FOR PITCHING BARRELS.—A. A. C. Klaucke, Washington, D. C.
110,374.—BRAIDING GUIDE FOR SEWING MACHINES.—Albert Komp, New York city.
110,375.—STONE DRILLING AND CHANNELING MACHINE.—E G. Lamson, Windsor, Vt.
110,376.—STONE-CHANNELING MACHINE.—E. G. Lamson, Windsor, Vt.
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110,381.—TABLE FAN.—J. C. McEwen, Micanopy, Fla.
110,382.—ELEVATOR FOR MERCHANDISE.—William McNaughten, Utica, Ohio. Antedated Dec. 9, 1870.
110,383.—SHOT CARTRIDGE.—R. R. Moffatt, Brooklyn, N. Y.
110,384.—RAILWAY RAIL JOINT.—William Morehouse, Buffalo, N. Y.
110,385.—METHOD OF FORMING SHAFT IRON FOR CARRIAGES.—F. B. Morse (assignor to himself and H. D. Smith & Co.), Plantsville Conn.
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110,389.—COMBINED PARLOR AND COOKING STOVE.—W. W. S. Orbeton, Bradford, Mass.
110,390.—SAW TOOTH SWAGE.—G. B. Pattee, Ottawa, Canada.
110,391.—STOP VALVE.—Robert Pilling, Waterford, N. Y.
110,392.—STUFFING BOX.—Andrew J. Prescott, Catawissa, Pa.
110,393.—COTTON PLANTER.—B. A. Ramsey, Trenton, Tenn. Antedated December 13, 1870.
110,394.—REFRIGERATING CAR.—T. L. Rankin, Granville, Ill.
110,395.—FOUNDATION FOR PAVEMENTS.—Selah Reeve, Chicago, Ill.
110,396.—VEHICLE.—J. D. Ross and M. K. Burke, Truckee, Cal.
110,397.—GRINDING MILL.—John H. Rusk, Philadelphia, Pa. Antedated December 9, 1870.
110,398.—MACHINE FOR TURNING LOGS.—E. H. Stearns, Erie, Pa.
110,399.—PIPE AND TUBE FOR WATER AND GAS.—H. M. Stow, San Francisco, Cal.
110,400.—COOKING STOVE.—David Stuart and Lewis Bridge (assignors to Stuart, Peterson & Co.), Philadelphia, Pa.
110,401.—WHEEL PLOW.—John H. Suydam, Atwater, Minn.
110,402.—SEAT HINGE FOR SCHOOL DESKS AND SETTEES.—N. O. Tiffany, Buffalo, N. Y.
110,403.—BARK ROSSER AND BREAKER.—G. S. Tillinghast and J. W. Burdwin, Morrisville, N. Y.
110,404.—STONE CHANNELING MACHINE.—F. C. Treadwell, Jr., New York city, and E. G. Lamson, Windsor, Vt.; said Treadwell assigns to said Lamson.
110,405.—PORTABLE DRILLING TOOL.—Claus Van Haagen (assignor to himself and Anthony Van Haagen) Philadelphia, Pa.
110,406.—GEAR-CUTTING MACHINE.—Claus Van Haagen (assignor to himself and Anthony Van Haagen), Philadelphia, Pa.
110,407.—GROOVING TOOL.—Claus Van Haagen (assignor to himself and Anthony Van Haagen), Philadelphia, Pa.
110,408.—SILVERING GLASS.—H. B. Walker, New York city.
110,409.—SCRUBBER AND MOP.—W. P. Walker and E. H. Leseman, Toledo, Ohio.
110,410.—IRONING TABLE BUREAUS.—Margaret White, Saratoga Springs, N. Y.
110,411.—COTTON PLOW.—James Wiley, Warsaw, N. C.
110,412.—LOCK.—Horatio Willard, Evansville, Ind.
110,413.—CHAIR.—J. C. Zimmerman, Thomaston, Ga.

## REISSUES.

4,203.—MANUFACTURE OF PAPER PULP FROM STRAW, ETC.—Asahel K. Eaton, New York city. Patent No. 41,982, dated March 22, 1864.
4,204.—PUMP.—Chalkley Griscom, Lewis Griscom, and John P. Griscom, Mahanoy Plane, Pa.—Patent No. 95,222, dated September 28, 1869.
4,205.—HASP FOR TRUNK LOCKS.—Lous Hillebrand, Philadelphia, Pa. Patent No. 94,111, dated September 21, 1869.
4,206.—METER.—J. C. Horton, New York, and S. K. Hawkins, Lansingburgh, N. Y., assignors to the Manhatten Meter Company.—Patent No. 68,746, dated September 10, 1867.
4,207.—CLOCK CASE.—Elias Ingraham, Bristol, Conn.—Patent No. 3,850, dated Feb. 15, 1870.
4,208.—TABLE CASTER.—Division A.—Cyrus H. Latham (assignor to Woods, Sherwood & Co.), Lowell, Mass.—Patent No. 104,743, dated June 28, 1870.
4,209.—CUP FOR CASTERS, ETC.—Division B.—C. H. Latham (assignor to Woods, Sherwood & Co.), Lowell, Mass.—Patent No. 104,743, dated June 28, 1870.
4,210.—MATERIAL FOR BEARINGS AND PACKINGS.—Eliza D. Murfey (assignors to the Manhatten Packing Manufacturing Company), New York city.—Patent No. 105,361, dated July 12, 1870.
4,211.—FRUIT JAR—T. G. Otterson, Philadelphia, Pa., assignor to S. B. Rowley.—Patent No. 36,833, dated November. 4, 1862; reissue No. 2,977, dated June 9, 1868.
4,212.—WAGON AND CAR UNLOADING APPARATUS.—Noah Swickard, Galva, assignor by mesne assignments to Nicholas E. Phillips and John W. Cline, Knox county, Ill.—Patent No. 83,005, dated October 13, 1868.
4,213.—CALENDAR CLOCK.—Wm. A. Terry, Bristol, Conn.—Patent No. 79,026, dated June 16, 1868.
4,214.—MACHINE FOR CUTTING NAILS.—Alonzo P. Winslow, Cleveland, Ohio.—Patent 108,225, dated October 11, 1870.

## DESIGNS.

4,522.—FRUIT JAR CLAMP.—Peter John Biesenbach, Rochester, N. Y.
4,523.—TUCK COMB.—Elias Brown, Wapinger's Falls, N. Y.
4,524.—CLOCK CASE.—Robert Dunn, Brooklyn, N. Y., assignor to Waterbury Clock Company, Waterbury, Conn.
4,525.—SHIRRED GOODS.—Ansel Hecht, New York city.
4,526 to 4,528.—WOVEN SHAWL FABRIC.—Joseph Hodgson (assignor to Thomas Dolan), Philadelphia, Pa. Three patents.
4,529 to 4,530.—TYPE.—J. K. Rogers, Brookline, Mass. Two patents.
4,531.—TYPE.—Carl Schraubstadter, Brookline, Mass.
4,532.—WOVEN FABRIC.—Royal C. Taft, W. B. Weeden, and J. W. Taft, Providence, R. I.
4,533.—MEDICINE DROPPER.—Henry A. Tweed, New York city.
4,534.—BLOCK OF SOAP.—Anthony Van Haagen, Philadelphia, Pa., assignor to McKeone, Alan Haagen & Co.

## TRADE MARKS.

109.—STOVE POLISH.—James L. Prescott, North Berwick, Me.
110.—TOBACCO.—R. R. Randolph, New York city.
111.—WATERPROOF GOODS.—Charles Toppan, Wakefield, and Moses F. Winn,, Woburn, Mass.

## EXTENSIONS.

MACHINES FOR HUSKING CORN.—Robert Bryson, of Schenectady, N. Y.—Letters patent No. 16,204, dated December 9, 1856.
MAKING CAST STEEL.—John Neville, of Brooklyn, N. Y.—Letters patent No. 16,214, dated December 9, 1856.
MACHINES FOR FORGING IRON.—Silas S. Putnam, of Nesponset, Mass.—Letters patent No. 16,186, dated December 9, 1856.
SECURING SPRINGS IN UPHOLSTERY.—Wendell Wright, of Bloomfield, N. J.—Letters Patent No. 16,254, dated December 13, 1856.
MACHINERY FOR FOLDING PAPER.—C. O. Crosby, of New Haven, Conn.—Letters Patent No. 16,266, dated December 23, 1856; reissue No. 3,687, dated October 26, 1869.


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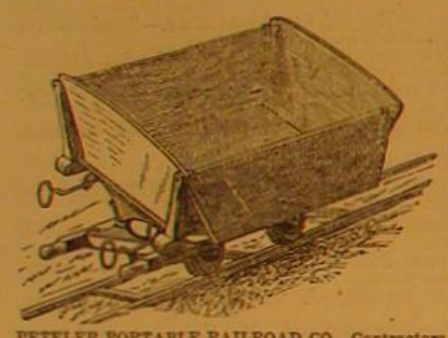

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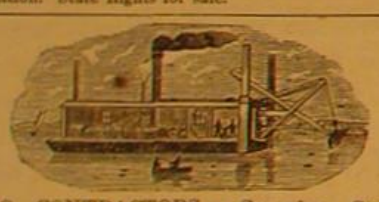

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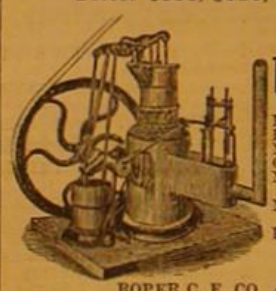

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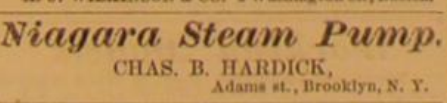

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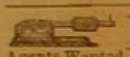

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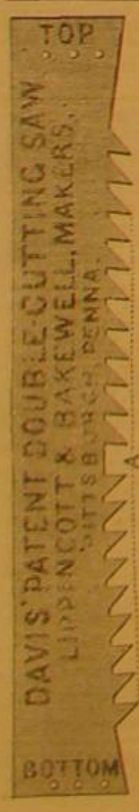


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# SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXIV.—No. 2. [NEW SERIES.] NEW YORK, JANUARY 7, 1871. $3 per Annum. [IN ADVANCE.]


### Mammoth Cylinder Lithographic Machine.

Our engraving is a representation of the largest lithographic press in America. It was manufactured by Hughes & Kimber, of London. Victor E. Mauger, No. 110 Reade street, New York, is agent for the sale not only of this machine, but also of the Wharfedale two-feeder printing press, not long since illustrated and described in this journal, together with lithographic materials, improved engines, cutting machines, etc., full particulars of which are specified in our advertising columns, to which the reader is referred.

Although this is the largest-sized machine of the kind yet built, the manufacturers are prepared to build still larger if desired. Such large presses are very useful in the printing of posters, maps, etc. We are informed by the firm in whose establishment the monster press is now running, that independent of a low bid for a government contract for map printing, they were awarded the contract because they could, on this press, print the map on a single sheet, and thus avoid subsequent piecing, which could not be done with any other press in the country.

Various sizes of this press are made, running down to those much smaller than the particular one under consideration. They are all precisely similar except in size, although size will, in the sequel, be shown to be a very important point. It will, of course, be impossible to go into minute details. Our purpose will be sufficiently accomplished by a comparison of the old method of lithographic printing with the present. To do this we will attempt to place before the reader a general outline of the art of lithography, than which no process has more points of general mechanical and scientific interest. We have before given a brief sketch of this process, but at the risk of repetition we will, at this time, dwell somewhat more minutely on its details.

The word lithography means the art of tracing letters, figures, and other designs on stone, and transferring them to paper by impression. This art has really nothing in common with engraving, as the surfaces printed from are perfectly smooth, having neither lines in relief nor lines sunk into the surface of the stone, except such as are uniformly distributed over the entire surface, by what is called the "graining" process—a slight roughening done by rubbing the surface with a muller of the same kind of stone, and silver sand of various degrees of fineness. For some kinds of work the stones are polished with pumice stone.

The stones employed are fine *oolite*, obtained chiefly from the interior of Germany. After graining, the design is drawn upon the stone with oily ink or crayons. If different colors are to be used in the same design, as many different stones as colors must be employed; and no single one of the stones has traced upon it the entire design, but only such a portion as is to be printed in one particular color.

The printing from stone in different colors has been appropriately called chromo-lithography, an art which has, through the aid of the press under consideration, risen to a rank second only to fine oil-painting.

The stones, having the designs drawn upon them in the manner described, are next treated with a mixture of dilute nitric acid and gum arabic. The acid attacks the portions of the stone not covered by the tracings of the design and dissolves its substance in a peculiar manner, the dissolved portions being replaced by the gum, so that the surface remains as smooth and uniform as before the acid is used.

The block or plate is now ready to be used in printing. The kind of press exclusively used before the introduction of the cylinder press, was called the scraper press. This press is still employed, but is slow in operation, liable to break the plates, and has many other defects, which do not exist in the cylinder press.

The scraper press consists essentially of a roller, the bearings of which are connected with a toggle joint and lever, by which the roller may be pressed up with considerable force, and a scraper fixed directly over and parallel to the roller. The scraper is made of apple-tree wood with a blunt edge at the bottom faced with leather.

In printing, the stone plate, prepared as described below, is placed with one edge between the scraper and the roller, and the roller being forced upward, by the lever and toggle joint, raises the stone till it is brought into forcible contact with the scraper. The roller is then turned by a winch which carries the stone along until its entire surface has been passed under the scraper and back again to its former position.

The preparation of the stone previous to submitting it to pressure, consists, first, in moistening it with water. Those parts acted upon by the nitric acid and gum, absorb water readily, while the parts not acted upon, being greasy, do not take water. Immediately after moistening the stone, the ink is rolled in, the moistened parts not taking the ink, which only adheres to the greasy portions constituting the design. The paper is then laid upon the stone, and a tympanum of zinc or leather laid upon the paper. This tympanum is brought in contact with the scraper, and the pressure transmitted through it to the paper. The paper having thus received the impression of the design, is removed, and the process described repeated for each subsequent impression.

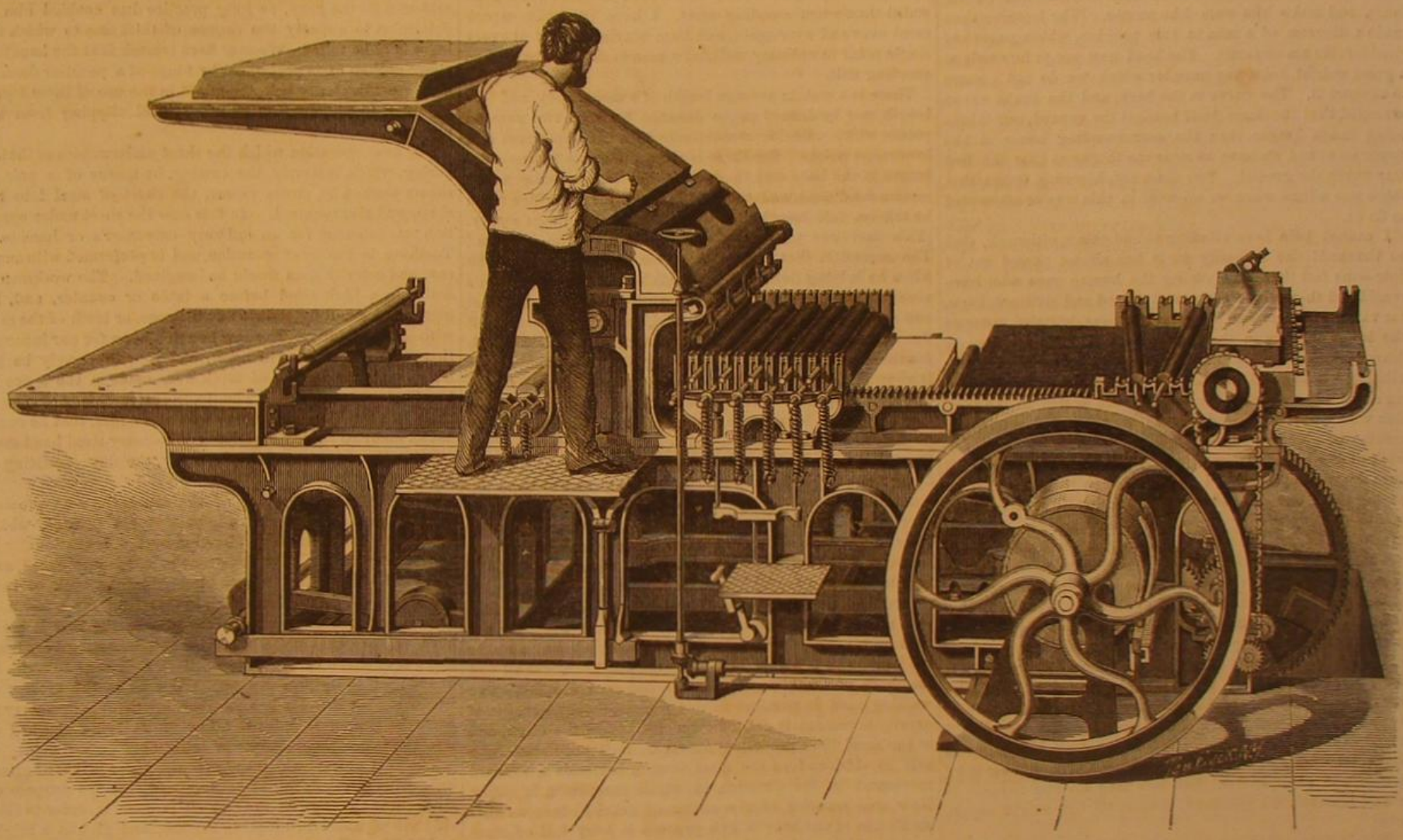
Now on the cylinder press every detail of this process is in its essential features performed automatically, except that the pressure is obtained by the weight of a heavy roller and powerful compound leverage connected therewith, which roller carries the paper and rolls over the surface of the stone in lieu of the roller, tympanum, and scraper, above described. The moistening of the stone, and the inking of the plate, are done by ingenious self-acting devices which perform the work in the most thorough manner, the dampening of the stone and the inking being done two or more times for each impression, as may be desired. Any kind of work is performed better than it can be done by the old means, and from twenty to thirty times faster. The press from which our engraving has been made will print blocks 60 by 40 inches, and as good lithographic stones of this size are difficult to obtain and handle, zinc is now much used as a substitute. The zinc is grained substantially in the same manner as the stones. The zinc plates are much cheaper, and may be obtained of any desired size.

The use of such plates—rendered possible by the large-sized cylinder presses—introduces the printing of life-sized pictures and portraits, and large posters, into the domain of the fine arts. Some of this kind of work now done at the establishment owning the press illustrated, is far superior to anything of the kind ever before produced in this country.

A peculiar advantage of the cylinder over the scraper, is, that the cylinder wears the stone much less than the scraper, so that from 20,000 to 30,000 impressions may be taken from a single transfer.

The press herewith illustrated is a model of strength, finish, and symmetry, and requires but little power. A great variety of sizes are manufactured, and a large number are in use in the principal cities of this country and Europe. The future of printing in this country will doubtless necessitate the combination of lithographic printing with type printing, as is already the case in Europe. The Hughes & Kimber lithographic press is admirably adapted to work in combination with the "Wharfedale," (illustrated in the SCIENTIFIC AMERICAN, June 25, 1870), by the same house; and it may furthermore be used for ordinary printing if desired.

The great advance made in the art education and instruction of the masses of late years, is perhaps due more to the advance in lithography, resulting from the introduction of these cylinder presses, than any other cause. Our readers will be gratified to see, and our engraving gives an accurate representation of, the press to which the public is greatly indebted for the general supply of cheap and good pictures.



HUGHES & KIMBER'S MONSTER CYLINDER LITHOGRAPHIC MACHINE.

11619

## HOW WE STAND AND WALK.

[Abstract of a Lecture Delivered before the American Institute by Prof. Burt G. Wilder.]

The second of the course of scientific lectures before the American Institute was delivered on the evening of Dec. 27, by Prof. Burt G. Wilder, of the Cornell University. The lecture was illustrated by diagrams and experiments.

After a somewhat humorous introduction the lecturer contrasted the walking of men with that of brutes. He said:

You will notice in menageries that the tallest apes are obliged to walk upon their feet as we should walk upon the hands, with the great toe standing out from the side of the foot, and the heel so short that it has not the power of supporting the body that our heel has. Here is a diagram of the skeleton of the foot of a man, and you see that the heel is long and strong; that the bones forming the arch of the foot are strongly put together. The great toe is the essential part of the foot in standing and in walking. If any of us have lost our great toes we should find immediately how difficult it is to balance ourselves upon our feet, because with man the use of the great toe lies in the propulsion of the body upon the feet, whereas in the gorilla the great toe stands out from the side of the foot like a thumb, and has no power whatever of supporting the body or propelling it like the man.

Du Chaillu tells wonderful stories of the grasping power of this hind hand of the ape, in which respect man's foot bears no comparison to it. Now, again, if you wish to see man at a disadvantage you have only to place him on all-fours, and make him walk like an ape. (The lecturer then made a diagram of a man in this position, which provoked considerable amusement). The head now hangs forwards as a great weight, requiring muscles which we do not possess to support it. The curve in the back, and the limbs are so arranged that the knee itself touches the ground, our thighs being much longer than the corresponding bones in the upper arm; and we have to raise the thighs so that the feet may touch the ground. You must not, however, forget that there was a time when we all went in this way or attempted to do so.

I cannot help here alluding to one thing, although, God be thanked! the necessity for it has almost passed out of date—the fact that some among the human race who have considered themselves even most refined and civilized, have, for various reasons and by various means, imitated some of the lower animals in their attitudes. If you were here to draw a human head and face with small jaws like this (exhibiting a head), and put on the back of it a great chignon, we should have simply the belle of the period in the position which she is obliged, by the very force of gravity, to assume in order to support this ponderous mass upon the back of her head. There is an old saying that "one good turn deserves another." I should change it in this case by saying that "one ill bend provokes another." In this Nineteenth century we have adopted what was originally the monkey bend, and not a Grecian or any other kind of bend.

There are several things to be said respecting the human foot, which is, of all the parts of the body, the least noticed. It is covered up, and not exposed at all times, like the hands. It has a degrading office, inasmuch as it is obliged to support the entire body upon it, and yet there are many things in the foot well worthy of our consideration. (Diagram of a foot, showing the way the bones are joined to form the arch, was exhibited, and the manner in which the body is supported was described). Now, in order that we should stand, it is necessary not merely that we shall be put up in an erect position—I might manufacture a pole representing a man, and set it upright, but how long do you suppose it would maintain its position? Not at all. It would topple over.

We do not realize the attention which is required of the mind to enable us to stand upright; yet there is a constant, although unconscious, attention of the brain, without which we could not maintain an erect attitude. And the muscles which lie along the legs, and which may be seen in the diagram, are in constant action. If you will stand on tiptoe, and let a person feel the muscles of the leg, they will be found in constant activity. There is a movement among them; some are falling backwards and some forwards, yet all are so adapted to each other that we are enabled to stand upright.

When we wish to lift ourselves upon tiptoe, then those muscles which are attached here (at the heel) contract with greater force. In ballet dancers and tight-rope walkers there is an immense development of the muscles of the calf, and indeed of the entire leg. The muscles attached to the end of the heel contract, the foot itself resting upon the ground, and form a lever of the second kind, as it is called, thus hoisting the body upon the toe; and the muscles which are required to keep the body on tiptoe are more than we dare enumerate almost.

Man's foot is called a plantigrade foot; that is, a foot which has the whole sole flat upon the earth. There is one other beast—and a very respectable one in his way, which has also a plantigrade foot, and that is the bear; but the bear's foot and method of using it differ from man's, and his method of using it, in this respect—that whereas as we walk we strike first the heel, and then roll forward upon the toe of each foot alternately, the bear lifts the whole of the foot together and puts it down flat, in precisely the same way that a negro clog dancer does. The bear has not the power to put down his heel first and then roll forward and give a spring as we do, but it puts it down flat, as any one of us would if we had a wooden leg. So that there is a difference both in the structure, and method of using, this useful member.

This brings us now to the subject of walking itself, which is properly the subject of the present lecture. I might take it up from half a dozen different points of view. After thinking the matter over I have concluded to approach it with reference, first, to a single familiar idea—the influence which walking, or which standing in different positions, has upon the hight of the body. There are three groups of facts which may be adduced in order to show that the hight of the body is affected to some extent during our walking and different modes of standing. One is the matter of common observation that we are shorter when standing upon one foot than when standing upon both.

[The lecturer's assistant at this point stood up beside a board, and his hight, standing first upon both feet and then upon one, was measured. Unfortunately for the theory, however, the man's altitude remained the same in both positions, a fact which brought smiles to the faces of the audience.] "I shall have to say, continued the Professor, "with a gentleman more distinguished than I can ever hope to be, who, when a certain experiment of his failed utterly, very coolly turned to his hearers and said: "Gentlemen, the experiment has failed, but the principle remains the same." [Laughter.]

The second matter in connection with this is stated by ladies—certainly good authorities in this day and generation—who say that the skirts of dresses which exactly clear the ground while the person is standing still, will, the instant they begin to walk, drag upon the earth; and in the third place, Dr. Oliver Wendell Holmes, who has written some upon this subject, has stated that a man is shorter when he walks than when standing erect. I have tried the experiment over and over again, and I am convinced that at every single point in ordinary walking a man is shorter than when standing still.

There is a certain average length of a man's body, and this length may be defined as the distance between two parallel planes which coincide respectively with his uppermost and lowermost points. But there is some difference between the length of the body and the hight. The length varies under certain conditions, and the first is that a man is taller when he takes a full breath than when he has his lungs empty. [This fact was practically demonstrated by the lecturer.] The second is that a man is shorter when he stands than when he is lying down flat upon his back. [The Professor's assistant laid down, and in that position measured five feet and eight inches; standing up, and carefully measured, it was shown that he was an inch shorter.] This difference is for the reason that when we are lying down, the whole body is allowed to stretch itself out, while in standing it settles down, so to speak. From the same cause comes the familiar fact that a man is taller in the morning than at night after he goes to bed. He loses, perhaps, an inch in the daytime. One other thing I will not stop to prove, and that is, that any deflection of the body from the perpendicular lessens the length of the body. We can prove that a man's body is shorter when it is bent. For instance, when we bend the body at the hips and spread the legs to any extent, or when we bend the knees, we become shorter. The hight of a body may be less, and yet its length be exactly the same.

In stating the phenomena of walking we have to consider two things—first, whether different parts of the body are bent upon each other when walking, and second, whether the body is swung from one side to the other. We shall find that both of these occur in every stage of walking. The walking man is peculiar in this respect, that the center of gravity is constantly shifted from one side to the other, and at the same time propelled forward. It is oscillated from side to side, and at the same time it performs a forward movement in the direction in which the person is going. Now this transfer of the center of gravity gives us that oscillation of the body which you see in very tall or stout persons when walking behind them. The leg of a giant is to the leg of a dwarf as is the pendulum of a large clock to that of a mantel clock. In the short man it swings more rapidly, in the tall man more slowly. The body is carried forward steadily, but the legs are not.

The lecturer then exhibited a gradigraph, a simple apparatus consisting of two hollow tin tubes placed so as to form a right-angle triangle, each tube containing a wooden piston resting on a spring, and having attached to the outer end a piece of charcoal. By means of this instrument he showed the variation in hight of a person while walking, and also the oscillation of the body from side to side. "I do not," said he, "claim for this instrument any wonderful powers, but it is, I think, possible by this means to get a more exact idea of the gaits of different nations. It would certainly be easy to recognize a gait having any distinct characteristics, as, for instance, a stage stride. We know that the French walk different from the Prussian, and the Prussian from the English. It is possible that this instrument may yet be perfected so as to measure the exact amount of oscillation upward and downward and from side to side. One very curious fact in regard to walking is that one side of the body always tends to outwalk the other side. It is not possible, when the eyes are shut, to walk in a straight line for any length of time. We have heard stories of persons losing their way in woods and on prairies, and coming out so as to indicate that they had been walking nearly in a circle. I have myself tried experiments in a large room, and have found on looking at a crack in the floor and closing the eyes, that it was impossible to keep that crack. I almost always turned to the right; and it will be found, where persons lose their way, that they almost invariably wander off to the right rather than the left.

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IT it estimated that there are at present in this city out of employment, 1,000 bricklayers and masons, 400 stair-builders, and 800 painters.

## MANUFACTURE OF SAWS IN SHEFFIELD.

[Condensed from The Ironmonger.]

We were first taken into the rolling mill, in order to witness the manufacturing process from its beginning, and we must confess we were at first rather startled by the sight which met our unaccustomed eyes, and by the sounds with which our ears were greeted. From every side, while red-hot metal was being thrown about in every direction, sounded the loud whirring of rolls, creaking of engines, snicking of shears, rumbling of wheels, and roaring of furnaces. Men stripped to their shirts, with perspiration starting from every pore, were busily employed in rolling ingots of steel, which are cast on the premises into sheets, bars, rods, etc.; but we at present have only to do with the sheets. Accordingly our conductor led us to a furnace of moderate dimensions, from which the furnace man took a red or rather white-hot ingot. We may here remark, that the ingots which are used for sheet rolling are of different shapes and dimensions, according to the size and description of saw they are intended to produce. The ingot having been taken from the furnace, is handed to the roller (we mean the man, not the rolling apparatus), who passes it between the rolls, it being received on the opposite side by another workman called the backer, and being by him repassed to the roller. After passing and repassing between the rolls several times, the ingot is transformed into a sheet of steel, the degree of thickness being determined by a gage, which the roller carries with him; he, however, seldom uses the gage, as long practice has enabled him to determine to a nicety the degree of thickness to which the ingot is to be rolled. We may here remark that the handling above spoken of is performed by tongs of a peculiar description, great dexterity being required in the use of these tongs, in order to prevent the sheet of steel slipping from the nippers.

The next operation which the sheet underwent was that of paring, which is simply the cutting, by means of a pair of shears worked by steam power, the sheet of steel into the shape and size required. In this case the sheet under operation was intended for an ordinary carpenter's or hand-saw. Toothing is the next operation, and is performed with more ease and celerity than would be imagined. The workman is seated on a high stool before a table or counter, and, by means of a small fly, strikes out the cogs, or teeth of the saw, with great rapidity. The saw he acted upon for our information contained about 115 teeth, and it will scarcely be believed that this number of teeth were made in the space of less than two minutes. The tooth-cutter informed us, in reply to a few questions which we put to him, that he could cut as many as twenty-four dozen of ordinary-sized hand-saws (say twenty-four inches long) in a day, the day consisting of about eight hours.

Hardening and tempering of the saw is the next process. For this purpose a large oven is built over a furnace, which being surrounded in every direction by fire, is continually in a state of red heat. Into this oven the saw is introduced, and when red hot is taken out and plunged into a tank or bath containing oil. After remaining in this bath for a few minutes, it is taken out, and by this process the saw is made hard, or, we would say, stiff. The saw becoming very bent, and out of shape by this process, it is necessary to smith it, or reduce it to its proper shape. But as in the process of hardening the saw has become very brittle, it is necessary to draw the temper, in order to allow of its being smithed or straightened without danger of breaking.

The next process which the saw undergoes is that of grinding. This is not, as might be supposed, for the purpose of sharpening the edge of the saw; it is done in order to take off the rough and dull looking surface, and give it a bright and highly polished appearance.

The grinding room is simply the shed or building within which the grindstones are placed. The grinding is performed by a grinder standing or sitting upon a horse (the block of wood placed at the back of the grindstones, upon which the workman stands or sits) and pressing the saw with all his weight and strength upon the grindstone. We must confess that we were agreeably surprised by the appearance of the saw-grinders, they being, we thought, remarkably mild and inoffensive-looking men, and exhibiting none of those signs of brutal ferocity which we had almost expected to find among the associates of the notorious Broadhead and Crookes, of saw grinders' trade-union celebrity. We noticed one thing with reference to the vocation of the saw grinders, which was that their work must, to say the least of it, be very disagreeable in cold weather, owing to the continuous stream of water that is pouring over their hands, our readers being, no doubt, aware that cold water is always flowing over the grindstones in order to neutralize the friction proceeding from the contact of the steel with the stone. The grinders, we are sorry to say, labor under the disadvantage of great danger in their work—apart from the danger which is always threatening them—and which cannot always be effectually guarded against, of the grindstones flying or breaking, thereby perhaps killing or seriously injuring all or a great number of the men in the grinding room, the men knowing that they are inhaling poison, and consequently death, with every breath they take, the particles of steel and of stone entering into their lungs, and sending them off the face of the earth, at, in many cases, a premature age. This being the case with the wet grinders, how then must it be with the dry grinders, who have not the advantage which the others enjoy of having many of the deadly particles taken off by the water? Besides this, in the case of the wet grinders the stone rotates *from* the workman, in the case of the dry grinders, the stone rotates in the opposite direction, that is to say *full in their faces*. We left the grinding wheel with feel-

ings saddened by the reflection that the fine-looking young men we had just seen employed, in full vigor of their youth and strength, were dying by inches.

The glazing or polishing room was the department next visited, and our saw was handed to a workman, who immediately proceeded to glaze and polish it. This he did by passing the saw over a wheel, in the same manner as the grinder had done. The wheel is made of very hard wood, and is placed in front of a stand or horse, upon which the operator stands with his feet resting upon a description of stirrup, the workman being, in fact, in the same position as the wet grinder. The wooden wheel being painted with a glutinous substance, is covered with emery.

The saw is next taken to the finishing room. Here at a long table sat two or three females at work varnishing the saw handles, while at different benches men were cutting the handles out of planks of wood. We may as well remark here that the handles are made of several kinds of wood, common saws bearing beech-wood handles, and the best saws generally having handles made of ebony or mahogany. The saw-handle maker taking a plank of beech wood, marked with a pencil six or eight handles upon the wood, he next with a small saw divided the wood into as many blocks, and gradually, and with great care, cut these blocks, by aid of the small saw, into the shape of saw handles; he then with a file, filed every portion of the handle down to smoothness, and passing it over to a woman who sat at the varnish table, she covered it by means of a small brush with varnish. The handle being then placed on a rack with a number of others, was left to get dry.

### Sewage Purification.

During the past twelve months a series of experiments has been carried on at the Ealing Sewage Works to test the system there adopted for the purification of the sewage of Ealing. These experiments have been carried out by Mr. Jones, the local surveyor, under the superintendence of Professor Way, who, after paying more than thirty visits, has drawn up a most favorable report, which was published by the Local Board authorities on Saturday last. The sewage of Ealing is dealt with by means of filter beds, of which the Professor thus speaks: "These filter beds are, in my opinion, of very great importance in carrying out any process of purification of the sewage previous to its discharge into the Thames. Without them it would be impossible, by the best precipitants known, to clarify the sewage in the tank, for no matter how perfect the system of precipitation may be, there is always some portion of flocculent matter which will not settle, and which can only be removed by filtration. These filter beds are an excellent feature of the Ealing Sewage Works." Speaking of the use of chemicals to precipitate the sewage, the Professor says: "Several years since I expressed the opinion that if to the system of filtration that of previous precipitation were added, the Ealing works would be among the most perfect, if not the most perfect, of their kind in the country. I have seen nothing recently to alter that opinion. The precipitants employed are lime and a cheap salt of iron, the latter made on the premises by a process suggested by myself. With the lime is used a preparation of tar, but the chief effect in the clarification of the sewage is undeniably due to the lime and the iron salt. Slaked lime is mixed with water and the tar compound, the lime is kept in suspension in the water by air pumped into it by a small steam engine, which is also used to pump water. The lime and tar compound are added to the sewage as it enters the works. It then passes to the tanks where the greater part of the suspended matter is deposited. At the last of the sub-division of the tanks, a solution of iron salt is allowed to flow into the sewage water, and advantage is taken of a slight fall to move a small water-wheel, which assists in the mixture of the iron salt with the water. The water then passes by upward filtration through two filter beds. It is not for a moment asserted that the effluent water at the Ealing works is pure, and the only question is whether it is rendered so far free from offensive matter as to allow of its discharge into the Thames. Since July, 1869, I have visited the works more than thirty times—two thirds of such visits being during the past hot and dry summer. The state of the water has necessarily varied with the more or less complete success of the treatment employed during the experiments; but since the system has been in good working order I have considered the result to be very satisfactory. The effluent water, though not absolutely bright, has only a faint milkiness, which a more liberal use of chemicals would entirely remove. It is free from smell, and samples that have been kept for weeks have only in rare instances become offensive. I have no doubt a moderate amount of attention will insure a uniformly good result."

### The Effects of the Franco-Prussian War on Industry in the North German States.

On entering Germany in August last the most unobservant of travelers could hardly fail to be impressed with the fact that war, for the time being, had become the first and almost sole business of the nation, or, more properly, of the Confederate Germanic States. In Rhenish and Northeastern Prussia production seemed to have been in a great degree arrested; few civilians were to be encountered, either upon the cars or at the hotels; while the transportation of merchandise by rail or boat, except for military purposes, was also apparently entirely suspended. Private letters written as late as the middle of October describe also the same condition of affairs, and make mention of the difficulty of even finding a blacksmith to shoe a horse in many of the German villages; with the further incident that even the sextons had left their churches and gone to the actual war districts in the capacity of *Krankenstager*, or hospital attendants, whose special duty is taking care of the dead.

The opinion of German authorities, more competent to judge than a transient observer, and since communicated to the writer, has been, however, to the effect that production is not really interrupted by reason of the war in Germany, as a whole, to a greater extent than 30 per cent; the interruption being greatest in Prussia proper, where the military conscription has been the most extensive, and least in the allied States, as Saxony and Bavaria, where a smaller proportion of the young, able-bodied men are drawn into the army; and in the German States and "free cities" which, like Nassau and Frankfort, have been incorporated with Prussia since 1866, and where the Prussian military laws have only been made applicable to those who have become of age since the date of incorporation.

The general effect of the interruption of industry in Germany by reason of the war may be inferred from the earnest appeals that have recently been made to the charity of all Germans in behalf of the working population of Rhenish Prussia, Hanover, Baden, and Hesse especially. One of these appeals brought to our notice, under date of September 28th, uses the following language:

"The towns in these districts are crowded with helpless women and children, coming in to beg for bread; the fields are left untilled; the villages are swept clean of food; while the price of all the necessaries of life have gone up threefold."

At a period as early as the last week in August the appearance in every German city, town, or hamlet of considerable numbers of men in uniform hobbling upon crutches, or with their arms or heads bandanged, testified most eloquently to the terrible results of the recent battles; while at the railway stations, or in the vicinity of the rooms or buildings appropriated for use as hospitals, the spectacle of women clad in mourning or weeping bitterly was not by any means unfrequent. There is also reason to believe, owing to the practice of grouping the local or district conscriptions into companies, battalions, or regiments, by themselves, that the almost entire destruction in some instances of such military integrals has been equivalent to the destruction of almost all the young, able-bodied men of certain small towns and villages. And as regards the comparative losses of the two armies, the opinion expressed to the writer by numbers of Prussian officers who were wounded in the battles before Metz were almost uniformly to the effect that the losses of the Prussians were greater than those of the French, inasmuch as the former were nearly always the attacking party, while their opponents, until routed, fought under cover or behind buildings, hedges, or intrenchments.—*David A. Wells in Lippincott's Magazine.*

### Zinc as a Roofing Material.

Hitherto our most available metallic roofing has in this country been tinned iron plate—an article imported almost entirely from Europe. In view of our extensive deposits of zinc, the subject of zinc as a roofing material is an important one, and hence the following notes, which we take from the London *Builder*, have a peculiar value:

"The use of zinc has rapidly increased in this country within the memory of the present generation. In 1845 the annual consumption was about 5,000 tuns, which had increased in 1860 to 25,000 tuns, or five-fold. Since then the progress has been still more rapid, and the returns of one company alone recently showed the figure of £45,000 as the gross of their annual transactions in zinc, used solely for roofing in England and the colonies; and future years will probably show a still greater increase if the arrangements now made to secure 'good work' be carefully carried out.

"We should premise that throughout the continent its use has been, and still is, more extensive. In Paris it is the leading material for roofs of every description. We may mention as examples the newer portion of the Tuilleries, all the new markets, nearly all the mansions of the new Boulevards, and the Champs Elysees, dating as far back as 1830. Other places throughout Europe may be quoted to any extent, but we think the above quite sufficient to prove that the material has established itself as adapted for works of good character.

"The more extended use of zinc, for roofs in this country, to which we at first alluded, dates from the year 1859, when the Vielle Montagne Company, the largest manufactory of zinc in the world, instituted a special inquiry into the causes of the failure of zinc here, which was conducted by Mr. James Edmeston; and the result was to show clearly that the faults did not arise from the nature of the material itself, but from the use of inferior quality in some instances, and improper workmanship in others. In all cases where the zinc was good and the work properly done, it has stood the test of time, requiring neither painting nor repairs, and when of proper thickness it forms one of the most lasting materials for roofing that can be employed.

"We may here point out the causes of failure which are to be avoided.

"The first is the quality of the metal, which, when manufactured from inferior ore, contains certain other metals in admixture with the zinc, which, when exposed to atmospheric influences, set up voltaic action, leading ultimately to the destruction of the metal; this kind of zinc is spotty and uneven in color, and darker than the proper quality manufactured from the best ore, the calamine.

"The second cause of failure is defective workmanship, using the zinc too thin, not allowing sufficient play for expansion and contraction, using iron nails, or allowing the zinc to come in contact with iron or lime; in either case a destructive chemical action being the result.

"As examples of work done in this country, we may notice the cloisters of Canterbury Cathedral covered twenty-four years ago, and which have not cost £5 for repairs; the Victoria Station, ten years ago, now in a perfectly satisfactory state; as well as many stations on different railways, and many other buildings in England.

"In conclusion, we may notice the peculiar way in which the atmosphere acts upon zinc. Quoting from a report made to the Academy of Sciences by the Director of the Conservatore des Arts et Metiers:

"'It appears from actual experiment that the oxidation proceeds for about four years, gradually diminishing after the first three months, and that it then hardens into a protecting coat, *email*, of a dark-gray color, preserving the metal beneath from any further deterioration.

"'It becomes evident that as a sheet of zinc exposed to the atmosphere for a series of years loses little or nothing of its weight or thickness, and as its surface remains hard and polished like enamel, it may fairly be deduced that the following years are not likely to occasion any alteration, and therefore zinc will be in the same condition as bronze, which is protected by its *patine* for ages.'

"There has been, to some extent, a prejudice against zinc as a lasting material, but with the evidence before us, we may safely say that where it is of a proper description and well laid, this is utterly unfounded. Its lightness and cheapness will doubtless render its use more extensive, if only necessary precautions be taken."

### Poker Pictures.

The curious productions known as poker pictures, or poker drawings, have neither paint nor inlay, neither pressing nor cutting. They are nothing but panels of wood in which dark shadings have been produced by the application of red-hot tools. Many school rooms, many country mansions, and some churches, are in possession of specimens of this kind of art. A Study of a Female head, a Tiger killing a Deer, the Temptation of Christ, Cornelius sending for St. Peter, the Savior bearing the Cross, the Good Samaritan, the Head of a Rabbi, Oliver Cromwell—these are among the subjects of such pictures known to have been produced in this eccentric department of art. Connoisseurs of poker pictures talk about Smith of Skipton, Cranch of Axminster, Thompson of Wilts, and Collis of Ireland, as artists of some note. About the beginning of the present century, there was an exhibition of poker pictures in London, comprising fifty-three specimens by a Mrs. Nelson, and thirteen by Miss Nelson. The pictures were, without any high-flown words, described as having been "done on wood with hot pokers." The scorching is effected by any heated bar of iron; but in the best specimens tools of various shapes are used, to make some of the scorched lines narrower and finer than others; the artist having, literally, many irons in the fire at once. The actual lines of the device are first penciled or drawn; the scorching is to produce the shadows, the lighter tints being the result of holding the red-hot iron very close to the wood, but not quite touching. If the panel has any strongly marked lines, fibers, knots, eyes, curls, or other diversities of grain, the artist sometimes avails himself of these to produce pictorial effect, scorching around or near them, according to circumstances. In one instance a knot in the wood was made to represent the eye in a portrait, by a few judicious touches of the scorching-iron; while in another case curled lines or grain-marks were made available to represent the furrows in an old man's cheek.

### How to Make Hens Lay.

People would better understand this matter, says the *Country Gentleman*, if they considered for a moment a hen to be, as she is, a small steam engine, with an egg-laying attachment, and thus there must be a constant supply of good feed and pure water to keep the engine and its attachment up to its work. In addition to keeping before hens, who have complete liberty, a constant supply of pure water, summer and winter, I have found that during the cool and cold weather of fall, winter, and spring, a dough compounded as follows, fed one day and then intermitted for two days, to produce excellent results: To three gallons of boiling water add one half an ounce of common salt, a teaspoonful of cayenne pepper, and four ounces of lard. Stir the mixture until the pepper has imparted considerable of its strength to the water. Meantime the salt will have been dissolved and the lard melted. Then, while yet boiling hot, stir in a meal made of oats and corn, ground together in equal proportions, until a stiff mush is formed. Set away to cool down to a milk warmth. Before feeding taste to see that you have an overdose neither of salt nor pepper, and to prevent the hens being imposed upon with a mixture not fit to be eaten. The hen mush should not be more salt than to suit your own taste, nor so hot with pepper that you could not swallow it, were so much in your broth. Beware of too much salt, too much lard, and too much pepper; and beware, too, where the seasoning is not too high, of feeding this dough too long at a time. Let the hens be fed one day fully with it, then let it be omitted and the ordinary feed given two days, and so on, and the result will be found satisfactory. *Take notice*—hens fed this way will be a good deal less inclined to set than when fed in the ordinary manner.

THE new method of supplying water to the Continental Hotel, in Philadelphia, by means of the artesian well, has, after a trial of seven weeks, proved satisfactory. The well is two hundred feet deep, one hundred and fifty-five of which were bored through solid rock. The bore is eight inches in diameter. Fifty thousand gallons of water can be obtained for use every day. The cost for the work was three thousand dollars. The water obtained is softer, purer, and much healthier, for both cooking and drinking purposes. The uniform temperature is fifty-five degrees.

### Improvements in Brick Machines and Brick Molds.

We illustrate in connection with the present article a brick machine and a brick mold, by the employment of which, it is claimed, considerable saving may be made upon the cost of making bricks in the ordinary pugmill and molding press, as the pressing is done automatically by a device connected with the mud-mill shaft, which shaft is propelled by the usual horse-power, or by other power, as may be convenient.

Fig. 1 is a perspective view of the machine; Fig. 2 a sectional elevation, and Figs. 3, 4, and 5, details showing the construction of the mold.

A is a weighted lever, pivoted at B to the side of the mud-mill, and connected to the stock, C, of the follower, D, Fig. 2, by a crank bolt or other device which will admit of the lever and follower rising and falling together. The lever, A, is connected by a rod, E, with the arm, F, of a crank shaft, mounted on the top of the mill, and having another crank arm, which is raised by the action of the cam, G, also raising the arm, F, and the weighted lever, A, and the follower, D, at the time the arms on the lower end of the mud-mill shaft are in position to fill the mold box, and allowing the whole arrangement to fall at the proper time for pressing the bricks in the mold. This simple movement automatically effects the pressing of the bricks.

The mold-box carriage, H, is mounted on a single strong beam, I, having slides, J, made of bent iron bars, attached to the under side and fitted in grooved supports, K, made vertically adjustable for regulating the carriage relatively to the bottom of the mold.

The carriage is moved back and forth by the oscillating shaft, L, and hand lever, M, in the ordinary way. N is a short lever pivoted to the front end of the carriage so that the short end will project upward in advance of the brick mold, and the longer arm hangs down so as to be arrested by a stop just before the termination of the inward movement of the carriage, whereby the short end will be forced against the mold box and clamped firmly against the plate, O, or other part of the mill to hold it while filling

*Fig. 1*

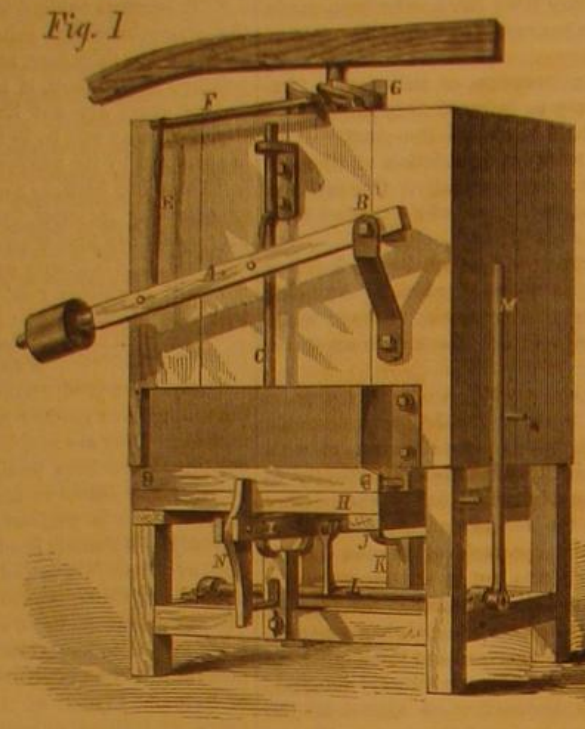
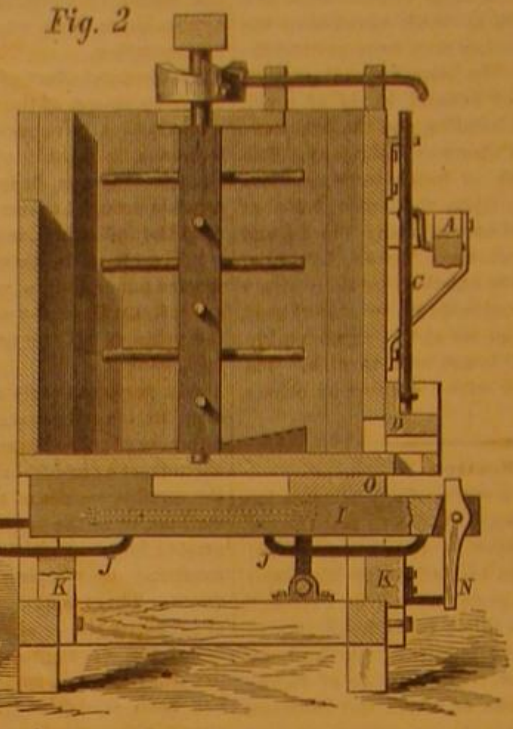



*Fig. 2*




TAYLOR'S BRICK MACHINE.

*Fig. 3*

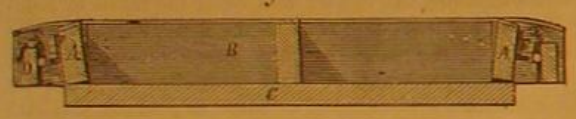



*Fig. 4*

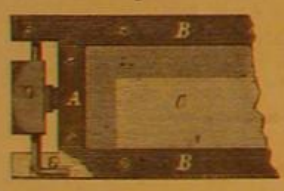
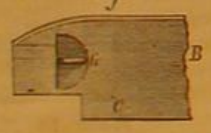



*Fig. 5*




The forward movement of the carriage releases the lever from the stop, so that the mold box may be drawn off the front over the short end of the lever, which will be turned down by the box.

Fig. 4 is a plan view of a portion of the mold box; Fig. 3 is a longitudinal section of the same, and Fig. 5 a partial side elevation.

The end pieces, A, of the mold are pivoted to the side pieces, B, near the bottom, C, or to the bottom itself, so as to swing outward, to release the pressed bricks when the mold is turned bottom up for discharging them, and the side pieces are also capable of swinging outward. For closing the ends and sides and holding them closed, pawls, D, are employed, pivoted near the edge and next the ends, A, of the mold, so that when the mold is right side up and held in the hands by the outside edges of the handles, the latter will turn on the pivots and cause the metal tappets, E, Fig. 3, placed on the inner edges, to bear against the plates, F, on the ends, A, and thus close the ends; and the crank arms, G, Fig. 4, will be forced down on inclines formed on the side pieces, thus forcing them together.

By this arrangement also the handles will be turned to release the ends, A, and sides, when the molds are turned bottom up and held so that at the time it is required to discharge the bricks they will be released from the friction on the ends and sides and escape more easily than if the ends and sides are immovable.

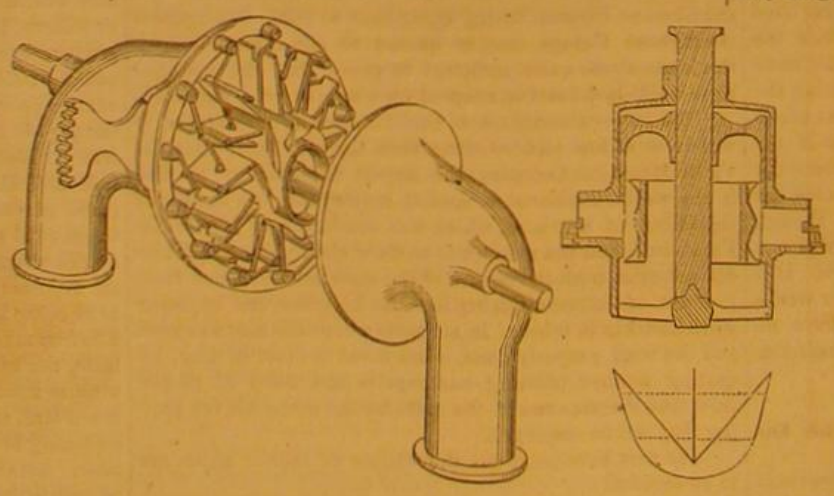
Patented, through the Scientific American Patent Agency, Nov. 29, 1870, by S. H. Taylor, assignor to himself and Le Grand Parker, either of whom address for further information, at Jacksonville, Ill.

### Rope Coffee and Spring-saw Beans.

A city paper says that Minnie Lee, a nice-looking young woman, residing at No. 128 West Tenth street recently applied for admission to the Tombs prison in order to visit James Thompson, a notorious and desperate burglar, now awaiting trial at the General Sessions. She had a dinner pail in her hand, containing coffee, and a large dish containing baked beans, which she pretended to have brought for the prisoner. The woman acted in a nervous manner, and so attracted the attention of the keeper, and he proceeded to examine the pail, finding it made with a false bottom, which was filled by a coil of rope fully thirty feet long, and neatly covered by hot coffee. Minnie was at once arrested, and the cell occupied closely examined, the search being rewarded by the discovery of two old knife blades, a patent jointed steel jimmy, and a couple of roughly-made spring saws, intended to sever iron bars. When the prisoner was arraigned before Justice Dowling, at the Tombs Police Court, she was fully committed for trial, in default of $1,000 bail. After Minnie was removed to a cell the plate of beans was examined and found to contain a handsomely-made spring saw handle, a small steel wedge, and ten or twelve beautiful watch-spring saws. With all of these tools, had he obtained possession of them, Thompson would have found no difficulty in escaping from his cell, and probably from the prison, during the night.

### IMPROVEMENT IN WATER WHEELS.

Our engraving shows an improved water wheel, invented by John C. Trullinger, of Oswego, Oregon, and patented by him, Feb. 11, 1868. The wheel is to be used both as a perpendicular and horizontal wheel. The wheel upon a horizontal shaft in the cases is set on the floor of the penstock, and the apertures cut in the floor for the escape of the water from the cases. The water is admitted to the buckets of the wheel through apertures of stationary guides, by gates, which are moved and adjusted by means of a series of levers, attached to the base of a movable ring. The direction given to the water by the guides causes it to impinge against the fore part of the buckets at the greatest diameter of the wheel, and, by means of the peculiar curve of the buckets in discharging, reacts upon the outer edge of the buckets and greatest diameter of the wheel, so that, it is claimed, the smallest quantity of water is used with as great a percentage of power as the largest quantity.



When the wheel is set upon a perpendicular shaft, the water is admitted by means of a gate-rig in the same manner as when the wheel is on a horizontal shaft, and impinges upon the bucket and reacts in the same manner, but discharges down through a lower case, and up over and down through the center of the wheel. The wheel is suspended by means of a hoop and hub, which is attached to the upper portion of the wheel, and rests upon a step in the lower case. The hoop and hub are inclosed by the upper case. The wheel being suspended by means of the hoop and hub, has no arms, and the water which discharges over the top and through the center of the wheel meets with no obstructions.

### The German North Polar Expedition.

In a letter from Gotha, dated the 1st of October, Dr. Petermann thus sums up the results of the expedition:

"The results and successes of the second German North Polar expedition are manifold in character, and relate to various branches of science; they prove the approachability of East Greenland in high latitudes; a comparative fullness of animal and vegetable life in the interior of the land, the existence of beds of brown coal, navigable fjordes, going deep into the country, immense mountains, as high as fourteen thousand feet, and for these latitudes a not unfavorable temperature.

"As the principal results may be assumed, that with this expedition a new path to the final exploration of the North Polar regions is opened, new ground trodden, a new direction taken, and a new basis won. From the lands lying nearest to East Greenland, for example, the west coast of Spitzbergen and Greenland, scientific circles had long possessed large natural scientific collections of every description, which have given of late years important insight, especially in regard to the geology and history of our earth; it is easy at any time to bring whole ship-loads of collections relating to these departments to Europe; but it was not so with East Greenland, this extended *vis-à-vis* of our quarter of the globe. Of this hitherto almost unknown, scientifically, great district, every exploration, every collection—every single petrification for example—is of especial value toward filling up the knowledge of our earth; Ober-Lieutenant Payer gathered on his various land excursions in East Greenland not less than twenty boxes of geological specimens, among them being many petrifications. With his theodolite he ascended up as high as seven thousand feet, accompanied by Dr. Copeland and Peter Ellinger. No other land possesses such magnificent characteristics, navigable fjordes, with a high temperature of water and air, immense mountains rising to a hight of fourteen thousand feet, great herds of musk-oxen and reindeer, etc., as Greenland.

"That a German expedition of discovery, fitted out from voluntary contributions from prince and people, has here opened up the way to the Pole, will bring imperishable fame to Germany. For more than five years great exertions have been made in England, France, and America to set afoot a scientific expedition for the exploration of the Central Arctic regions. Germany, however, has gone first into actual duty, and has achieved already great results."

### Sewing Machines.

The number of these machines made by twelve principal companies during the past year amounted to 320,669, which, at the average price of a first class machine, say $75, aggregated total, $24,050,170. The first class American sewing machine is to be found in all quarters of the world, and the supply comes principally from this city and Boston. There are many cheap machines which are sold all the way from two to twenty dollars, which are not counted in these figures; also many cheap imitations of the best American machines manufactured in England and on the Continent which are sold as of American make. Germany, in particular, does a very large business of this kind, Hamburg having no less than six large factories running, and finding a market principally in Russia, with which country we have comparatively little direct trade. Notwithstanding this competition, the machines sent from this country command high prices abroad, on account of excellence in workmanship and finish, and are exported in large numbers annually. All of the largest manufacturers have agencies in the principal cities of Europe, and receive large orders from abroad by nearly every steamer. The largest number made by any one concern in a year was 86,781. Notwithstanding the large amount of work which can be done by these ingenious contrivances, which used to be done entirely by hand, there seems to be no diminution of hand work in many branches of business. As the cost of manufacturing good machines varies from $12·50 to $60, and the prices at which they are sold range from $60 to $350, the profits of the business are enormous.

THE AMERICAN DESERT.—R. S. Elliott, Industrial Agent of the Kansas and Pacific Railroad, reports upon extensive experiments to cultivate the soil of the great plain, or American desert, along that road. Irrigation was dispensed with, and success is claimed, the result being thus summarized: Forests can be established in all parts of the plains, even without artificial irrigation. Much deeper plowing will be required than for winter grains or forage plants. The most rapid growers are the best trees for first planting. Planting seeds is better than to transplant young trees.

## PERPETUAL MOTION.

NUMBER VI.

In 1865, Herman Leonhardt, of St. Gall, Switzerland, invented a new motive-power engine, which he thus describes:

"I avail myself of the property of bodies or objects of a certain specific gravity when immersed in a fluid of a greater specific gravity to rise or ascend to the surface of such fluid. This buoyancy represents a greater or lesser force or power according to the greater or lesser difference between the specific gravity of the object and that of the fluid, and the size of or the displacement caused in the fluid by such object. In order to make the said objects, which I will call floats (see Fig. 13), as light as possible, and yet strong enough to resist the pressure of the water, I construct them of thin sheet metal, and in preference, in the form of tubes or hollow cylinders with flat ends. A number or series of these cylinders placed horizontally parallel to each other, are hinged or linked together in a similar manner as the buckets of a chain pump; this chain of floats is passed over two sets of pulleys or disks fixed to two horizontal shafts, the one placed vertically above the other, the said pulleys being formed to suit the diameter of the floats. One half of this chain of floats passes through the center of the tank holding the water or other fluid, and the other half passes outside the tank through the air. The floats, when in motion, enter through the bottom of the tank, in the manner hereafter described, and rise up by their buoyancy through the water; they then pass round the top pulley, descend outside the tank, and passing over the bottom pulley, again enter the tank, and so on. If cylindrical floats are used, as described, they are fixed on the connecting links half a diameter or more apart from each other; therefore supposing the floats to be fifty centimeters in diameter they would be placed twenty-five centimeters apart.

"Now the principal part of my invention consists in relieving the floats, when entering through the bottom of the tank, of the pressure of the water column, which pressure, if not removed or neutralized, would render the rising of the floats in the water impossible, and prevent the machine from acting. The manner in which the floats are relieved from the pressure of the water column when entering the tank is as follows: On the bottom of the tank I form an entrance chamber for the said floats of a depth equal to the diameter of a float; the bottom of the chamber and its top are each provided with double slides which open and close as the floats enter and leave the chamber. Supposing the floats to be in motion, and one of them to have arrived in the center of the chamber, a lever actuated by the moving floats or by the revolving float pulley or disk, will cause the top or egress slides of the chamber to open in the same measure as the float rises; this slide, acting through another lever, will, at the same time, open a slide or valve in the side of the chamber and admit water into it, thereby bringing the water in the tank and in the chamber into equilibrium. When one half of the float has passed through the top or egress slide, the next float will have arrived at the bottom or ingress slide, which latter will now open in proportion to the rise of the float. The egress slide will close in the same measure and at the same time shut off the communication between the tank and the chamber, which was necessary for establishing the equilibrium. At this juncture other valves connecting the chamber with pipes leading to the top of the tank are opened, and the water in the chamber, which would be detrimental to the further rise of the entering float is withdrawn through these pipes, which I will call return pipes, by suction, and allowed to flow back into the tank above the water level; this suction is effected through the following arrangement:—That portion of the top of the tank where the floats leave the water is open, but the other portion of it is covered, and a partition dividing it from the open portion is made to dip into the water to some depth, thereby rendering it a hermetically closed chamber, and the above-mentioned return pipes open at a certain hight above the water-line into it. This chamber I call the vacuum chamber, because previous to starting the machine a vacuum or a partial vacuum must be formed in it, and afterwards maintained as long as the machine is to continue in operation. The air is exhausted from the chamber by means of an air pump driven by the machine, but arranged for driving by hand for the purpose of starting the machine. By forming this vacuum the original water level in the tank will be disturbed, the water level being raised in the vacuum chamber and lowered to a corresponding extent in the open part of the tank. Supposing the tank to be of a hight to hold six floats 1, 2, 3, 4, 5, and 6, 1 being the one above described, as entering the admission chamber, it is clear that as 6 leaves the water, the water level in the open part of the tank will be lowered in proportion to the displacement previously caused by 6, and the water level in the vacuum chamber being thereby likewise lowered, it will cause a suction or drawing up of water in the return pipes, equal in quantity to the amount of water displaced in the entrance chamber by the entering float, 1. The water sucked up through the return pipes will flow over into the vacuum chamber and distribute itself in the water of the tank. The ingress and egress slides of the entrance chamber are furnished with linings or packing of felt previously boiled in oil for insuring a water-tight fit against the floats without much friction, and the flat ends of the floats likewise pass between sheets of felt previously boiled in oil and pressed against the flat ends by fluted rollers. The air pump is maintained in operation in order to remove the trifling quantity of atmospheric air adhering to and introduced into the tank by the entering floats. The motion communicated by the rising floats to the float pulleys or disks and shafts, is further transmitted by means of belts or other gearing, in the manner usual with other motive-power engines.

FIG. 13.

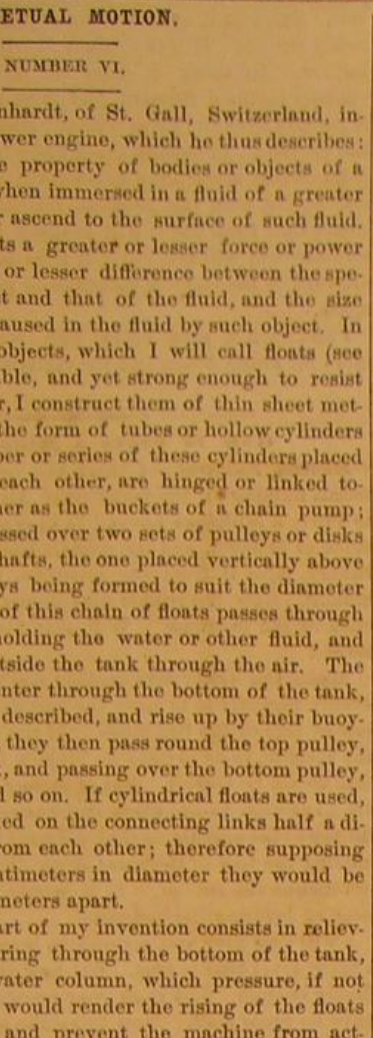
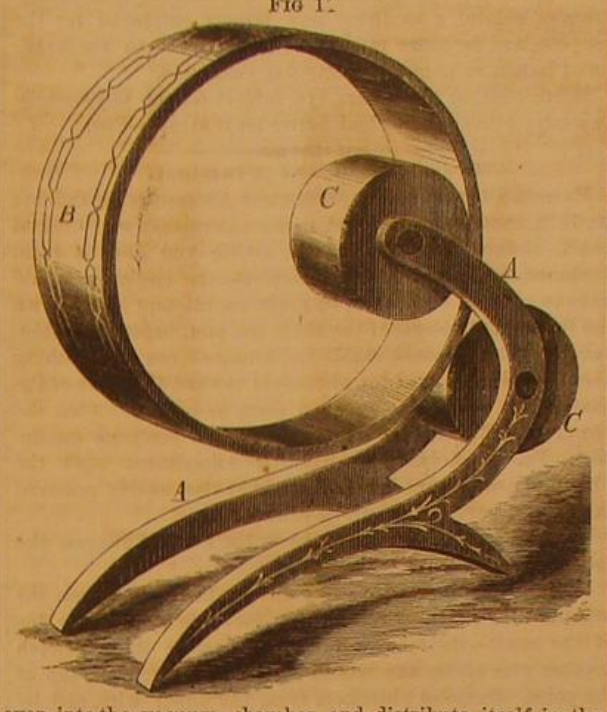


FIG 14.




"The details of arrangement and construction of my new motive-power engine may be altered or varied, but the main features of my invention consist in relieving the floats, when entering the tank, of the pressure of the water column by means of a vacuum chamber and parts connected therewith, as described, or their equivalents."

Only about a year since the *London Mining Journal* described a machine, patented in England, the essential features of which did not differ from those of Leonhardt; and what is more, expressed a favorable opinion of it.

We have received several letters with diagrams of "perpetual-motion machines" from correspondents, one of which we will herewith present, and defer others for future articles.

Fig. 14 is a diagram sent us by F. G. Woodward, whose address was not given in his letter.

The writer says: "It consists of a stand, A, two idler pulleys, C, between which a hollow cylindrical ring, suspended in the manner shown, is expected to revolve in the direction indicated by the arrows." The only difficulty about it is, that it will not work, though it looks plausible enough.

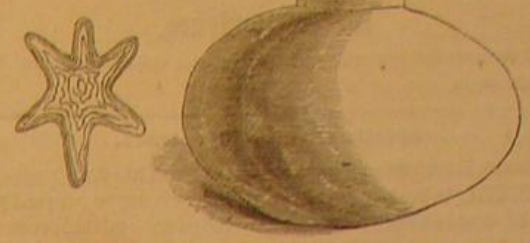
## THE HAIL-STORM OF JUNE 20, 1870.

This remarkable storm swept along a path about thirty miles wide, and extending from Troy, N. Y., to Bangor, Me., though it was not everywhere accompanied by hail.

My point of observation was in Northampton, Mass., which was in the central line of the storm.

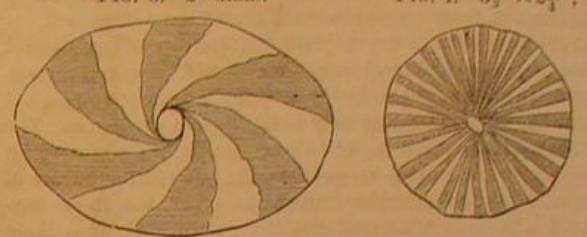
At sunrise the atmosphere was obscured by fog, which was partially dispersed at a later hour. The day was sultry. At noon the thermometer indicated 88° in the shade. At 3 P. M. a vast mass of dark-green cloud rolled up from the N. W., while lateral currents seemed to set in, forcing the clouds at first into confusion, but afterwards into a well-defined vortex, or spout. The electrical detonations were frequent and sharp. No rain preceded the hail, though it fell copiously after a few minutes. The first hail-stones were about one inch in diameter, and seemed to fall from a greater hight, and with more force, than those that fell subsequently. The latter were probably nearer the center of the vortex, and so had their downward motion restrained by that which was lateral. The first that fell were, most of them, on striking the ground, instantly buried out of sight. If they struck on a rocky surface they were dashed in pieces, or else rebounded to a considerable hight in the air. Had their larger successors been driven by a corresponding force, nothing could have survived their assault. The smaller hail-stones were generally flattened spheres, though sometimes in rude stellar forms, Fig. 1. But the largest ones were symmetrical ovoids; each being surmounted, however, by a roughened crown, Fig. 2. The dimensions and weight of three specimens are given, with such accuracy as could be secured by the means at hand. These are but samples of thousands that fell till the earth was covered with ice. The first was, in long diameter, 3⅜ inches; short diameter, 2⅛ inches; weight, 7 ounces. The second was 3¼ inches by 2¼; weight, 8 ounces. The third was 4 inches by 2⅜; weight, 10 ounces. This monster, a foot

FIG. 1. FIG. 2. 3¼" × 2¼".



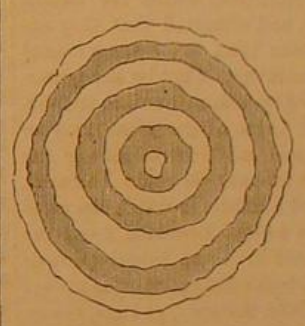
in circumference, did not entirely melt away for six hours after it fell! The ice in all the hail-stones was peculiarly hard and compact. Interesting structural peculiarities were noted. Hail-stones of stellar form were always transparent and homogeneous. The spheroids were covered with an opaque coating, and had likewise an opaque center. On being bisected some of them showed a radiated structure, the alternate rays being white and clear, Fig. 3. The largest hail-stones had an axis of white ice, half an inch in diameter,

FIG. 3. 2" diam. FIG. 4. 3½"×2¼".



around which the alternate layers were arranged in spiral convolutions, Fig. 4. The most common form was in concentric layers, like the coats of an onion, still alternating opaque and transparent; but the edges were finely serrated, like the stripes in some species of agate, Fig. 5. In one hail-stone I counted thirteen of these layers, indicating that it had passed through as many strata of snowy and vaporous cloud.

FIG. 5. 3" diam.



After a lull in the storm, for half an hour, there was a second fall of hail, but much lighter than the first.

The damage done by such a war of the elements cannot easily be ascertained. Vegetation suffered greatly. In some cases men and animals were wounded. The icy missiles not only broke thousands of panes of glass, but also in many instances the window-blinds and sash. In a few cases weather-worn house roofs were pierced.—*Rev. Horace C. Hovey, M. A., in the American Journal of Science.*

## IMPLEMENT FOR GRINDING VALVES.

This device was invented to supply an easy method of regrinding the Peet valve. The valve is an extremely efficient one, and has achieved, we are glad to say, great popularity. It is now extensively used both in this country and in Europe. The great durability of the valve renders regrinding seldom necessary, but when this operation is required the instrument under consideration supplies a very simple and ready means for accomplishing the desired object.

Fig. 1

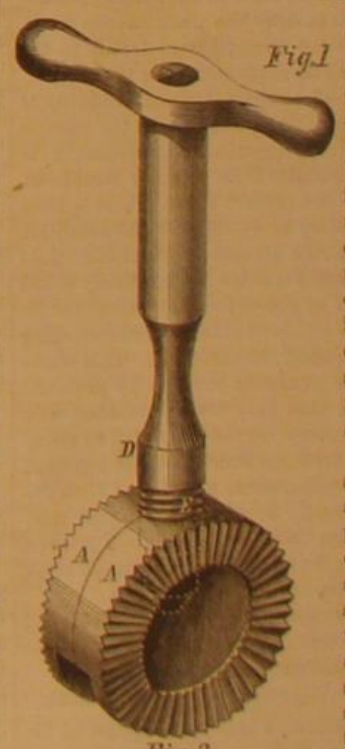



Fig. 2

It consists of a pair of steel disks, A, made parallel like the valve disks, provided with serrated cutters upon their outer surfaces. Their interior surfaces are provided with wedge-shaped cavities, B, and the thread, C. The stem, D, is made with a screw, E, corresponding to the thread, C, in the disks. The conical wedge, F, is fitted to the cavities, B.

By removing the bonnet from the valve body, and placing the stem in its position in the disks, the grinder may be slipped into the valve body. A slight turn of the stem drives the wedge forward and forces the cutters firmly against the seats. A rocking motion of the stem will then polish down the valve seats to a perfect joint.

The valve disks are readily ground by placing a piece of fine emery cloth on a piece of planed iron and rubbing the disk face on it until it is perfect. The "Peet" valve is not

weakened by regrinding, as is the case with the globe valve, but it may be safely repaired many times.

The office of the Peet Valve Company is at 152 Hampden street, Boston, Mass., where users of the valve may obtain this grinding implement.

## Correspondence.

*The Editors are not responsible for the opinions expressed by their Correspondents.*

### Spiritualism and Science.

MESSRS. EDITORS:—The article under this heading, page 360, Vol. XXIII., is certainly well intended, serving to prevent persons of feeble mind from being deluded into mischievous notions of spiritual intercourse with departed beings, the basis of which is fallacious. Unless qualified, however, the said article is apt to confirm an error in another direction—an error which we find only too frequent. In proving the fallacy of the theory of spiritualism (as spirit manifestations, etc.,) phenomena of a quite different nature, having no connection whatever with the delusive theory—and which, by the way, are as stubborn facts as the growth of organism from the germ, or, indeed, nearly all animal function that at present baffles explanation—are classed under the same head, and, by implication, their existence is attempted to be disproved, for the reason that they are beyond explanation in the present state of scientific knowledge. We should, however, remember that we know absolutely nothing of many things, but that they take place, and only under certain conditions. The phenomena referred to are those generally designated as mesmerism, or animal magnetism, the powerful influence of the will of one individual upon the other, the trance produced, a more or less genuine clairvoyance, etc. That these conditions can be and are induced, no candid investigator in our time will deny; and that they are taken advantage of for deception is no reason to deny their genuineness under the proper conditions. Remember, there is nothing so noble that cannot be abused, or be made the guise for unworthy motives or actions. Love and the religious sentiment may be accepted as the most elevated conceptions which the human mind is capable of entertaining, and admitted that they are oftener perverted to base purposes than to good, we cannot denounce them as delusions, or humbug. That by the powerful will of the operator the whole system of another individual, bodily functions as well as those of the mind, may be controlled, was probably known and made use of among the first societies of men. They found that ills could be cured, insensibility to pain produced, and a trance, in which the mind appears to be to a greater or less extent liberated from the fetters of the body, the veil raised from an inner vision or perception, which penetrates through solid extraneous matter as through thin air; in fact, matter, distance, or time, ceases to interfere with a perception by which the mind places itself in communication with everything without and within. Admitted that the cases are rare in which the mind, while in such condition, is not influenced by the minds of surrounding individuals, nor by its own individual constitutional peculiarities, trainings, or aims. Finally, the faculty of giving utterance about objects or facts perceived, may be imperfect. But the rarity of a more complete state of the kind explained should not carry us so far as to deny the phenomenon itself. Prof. Gregory Ersdale and other investigators testify to the facts, though they fail to give an explanation for them.

It seems, however, a part of common human credulity to receive the rambling utterances of individuals in the state of trance, in a mood which favors deception, and, awe-struck, to connect them with communications from another world—instance the oracles of ancient and modern times. There is little disposition in general, or ability to examine if the condition is genuine, or unintentional, or purposely fictitious. And granted genuine, the utterances cannot be implicitly relied upon, because we are unable to detect to what extent the individual is influenced by the minds of others, by surrounding objects, or by its own individual constitution. This whole subject, moreover, is one too generally avoided by profound investigators, for the reason that they fear association with professional cheats and deceivers, or that they fail to recognize a tangible basis to start from, on which to build a system. The consequence is, that the phenomena are viewed with distrust and ignored, if not actually repudiated. In this manner, however, as we have seen in other branches of science, nothing is cleared up; the darkness remains, and under cloak of it cheats and impostors play their nefarious game.

Let us have light on this subject, if attainable, by starting from what we know of the working of the mind, and progressively learn what the mind may be capable of.

New York city. R. H.

[The whole subject of mesmerism was investigated by Dr. James Braid, of Manchester, England, in 1842, and his researches lead to the discovery of *hypnotism*, to which this class of phenomena can now be referred. There is no doubt about the partial sleep of certain faculties, while others are wide awake; and Dr. Hammond, of New York, gives remarkable instances from his own practice. The peculiar condition of nervous sleep, called hypnotic, which is produced in certain people by their fixedly gazing at an object, is entirely a subjective phenomenon, and does not depend upon any external force, electrical, magnetic, or nervous, coming from another person, but, under proper conditions, arises spontaneously, just like ordinary sleep. Some persons, as Dr. Hammond relates, pass into the hypnotic state of their own accord, and with the utmost readiness, and are "natural clairvoyants," or "spiritual mediums."

Unconscious cerebration has been a subject of study for a long time, and most of the phenomena are capable of scientific explanation. There is not the slightest necessity of making a mystery of them. Those who are "natural clairvoyants" are fit subjects for the care of a physician, and when they neglect the warnings of nature they are certain, sooner or later, to demand medical treatment when it is generally too late. Mesmerism served one good purpose, and that was to call the attention of scientific men to the possibility of performing surgical operations while the patient was insensible. Some of our older readers will remember that this was one of the strongest claims of the earliest advocates of mesmeric doctrines. The idea was at once seized upon as important, and in the course of researches on the subject, ether was suggested as an anesthetic agent. Afterwards, chloroform and nitrous oxide were employed, and in July, 1869, a new method of producing the hypnotic state was discovered in the hydrate of chloral, a medicine now largely employed for the purpose, and far more rational and effective than the laying on of hands, so popular twenty-five years ago.

Mesmerism, or hypnotism, is a subject for the physiologist to study; other persons had better let it alone.—EDS.

### Deviation of the Plummet.

MESSRS. EDITORS:—The SCIENTIFIC AMERICAN for October 29, 1870, contains an editorial under the caption of "Central Shaft—Hoosac Tunnel." In that article you gave a lucid explanation of some of the difficulties the engineer would have to contend with when he made an attempt to lay down the line on the bottom of the shaft, but you forgot to mention one difficulty of considerable importance—you said nothing about the deviation of the plummets toward that side of the shaft upon which the greatest mass is located. That the plummets will lean toward that side is a foregone conclusion, Dr. Maskelyne's celebrated experiment with the plummet near Mount Schehallien, in Wales, having removed the subject beyond the pale of controversy.

To ascertain the amount of deviation I would suggest the following expedient:

With a No. 9 iron wire carry the surface line across the mouth of the shaft. Erect a thirty-foot pole upon either side of the shaft—their bases upon the surface line. Stretch another wire across the mouth of the shaft from the top of the poles. Suspend plummets from the upper wire, and by means of guys attached to the poles strain the points of the plummets exactly over the lower wire. Make all secure, and go below, taking with you two photographic cameras, so modified as will enable negatives to be taken of the zenith. Place one on either side of the bottom of the shaft, perfectly level, and on the tunnel line as established by the plummets. Of course there must be a line cut upon the back of the glass negative, and that cut line must cover the line of tunnel as established by the plummets. Photograph the wires overhead, and when the negatives are finished hold them between your eyes and a strong light. Unless I am very much mistaken, the photograph of the wires will appear like a thin wedge laid across the cut line at an acute angle, the apex pointing towards the center of the shaft. The right-hand plane of one wedge should, if extended, form the left-hand plane of the opposite wedge. The base of the wedges will show how much the tunnel line is out of truth. Photographs showing a clean single wire directly over the cut line will indicate that the true line for the tunnel has been found. Compare the true line with their other and their difference is the amount of plummet deviation.

Perhaps there will be three objections made to the foregoing method:

1st. The test requires too much nicety and perfection of workmanship.

2d. The shaft is too dark.

3d. The wires are too small.

As to the first, I reply that any method must be extremely nice, and the workmanship of the very best.

As to the second, the shaft may be dark so long as the wires remain in the light.

As to the third, it is untenable. In my possession there is a photograph on card-board showing the stem of an oak leaf which was 820 feet distant from the camera.

New York city. R. B. S.

### Poisonous Effects of Bee-stings---A Preventive.

MESSRS. EDITORS:—The poisonous effects of a bee-sting can be prevented, or at least considerably mitigated, by passing over it the pipe of an ordinary trunk key.

The reason is obvious. The pipe acting as an annular compress close to the puncture, forces the poison out. Could not this simple process be extended in its application to the bites of serpents and rabid dogs? The absorption and spread of the virus might thus be prevented, or at least retarded, until a physician could arrive with a more effective remedy.

Albany, N. Y. ANTIDOTE.

### Glass Cutting.

MESSRS. EDITORS:—The glazier's diamond is an angle of a crystal, the extreme point of which may be regarded as a single atom, which, when pressed upon the glass, acts like a wedge, entering between two particles of glass and producing a minute fracture. When drawn over the glass it produces an infinite number of minute fractures, extending sometimes quite through the glass. A sharp point of iron or lead will not cut glass because it is too soft. The extreme point or atom yields when pressed upon the glass, allowing two or more atoms to touch the glass, which act no longer as a wedge, but as a weight, and if sufficient force be applied, a large and irregular fracture will result.

A sharp point of hardened steel will cut glass nearly as well as a diamond. Take an old worn-out three-cornered file, grind the end to a three-cornered point, heat it red hot, and immediately plunge it into a mixture of snow and salt. Retouch it on the stone to remove the scale, and it is ready for use. If rightly done it will give very good satisfaction. In using it hold the file nearly perpendicular, slightly inclined forward, and with a gentle pressure draw it rapidly over the glass without changing its inclination to the surface. In cutting thick glass it is safer to cut on both sides before attempting to separate the pieces, but thin glass may be cut with the greatest facility. When the point becomes dull from use it will produce only a ragged surface—scratch—but will not cut. It then needs regrinding. A single turn of the stone is sufficient to put it into working order again.

I find such a glass cutter very serviceable for preparing glass for honey boxes and for various other purposes.

J. H. P.

### How to Prove a Millstone Level.

MESSRS. EDITORS:—I think the writer of the article in a recent number of the SCIENTIFIC AMERICAN, headed "How to Prove a Millstone Level," is in error. Suppose the bedstone to be level, and the spindle trammed to it; put on the runner, raise it from the bedstone, and set the runner in motion. Now the runner may be out of balance, if so it will click on the bedstone. Will this prove the bedstone is not level?

Again, the writer says another way to make the stones come evenly together is to move the bottom of the spindle *from* the lowest side of the bed stone. If the runner was fastened on the spindle, so as to have no play on the top of the spindle, this would be correct. But at present the irons in millstones are so arranged as to allow the runner to balance and play on the top of the spindle, so that inclining the top of the spindle by moving the foot of the same in an opposite direction, would not incline the runner. If it would, there would be no real need of leveling the bedstone.

I will now give you my plan to level a millstone. Procure a spirit level that is true. But how shall its truth be tested? Easily enough. Lay it on your proof staff, or red staff, if you have no proof staff. Now bring the staff to an approximate level, and change ends with the level, and if it shows the same each way it is true. If it is not true, plane off the bottom of the level, or paste paper on one end at the bottom of the level, until both ends show alike.

Having the bedstone in good face, proceed to level it. The level being true, the stone leveled by it will be true, and will need no proving. Now tram the spindle to it, put on the runner, and set it in motion. The spindle being tight in the step and bush, if the runner ticks on the bedstone, it will not prove the bedstone is not level, but it *will* prove that the irons are not properly fitted, or the runner is out of balance, or both.

Grand Haven, Mich. THOMAS BRADFIELD.

### Sounds Produced by Telegraph Wires.

MESSRS. EDITORS:—Having frequently noticed the humming from telegraph poles alluded to by F. P. Dodge, in a recent issue of the SCIENTIFIC AMERICAN, I have no hesitation in assigning said humming to the action of the wind. The telegraph wire forms an Eolian harp, of which the wind is the motor, the wire string the vibrating body, and the poles suspending the wire regulate the tension upon which its pitch depends.

To account for special intensity of sound from a particular pole, a variety of causes may operate and contribute either singly or together. These may be the near presence of a good conductor, as a board fence, a sewer, or covered ditch, or a firm foundation for the pole itself, the adjoining length of wire being exposed to a particular blast or current.

A wire stretched at a certain tension, between unyielding bearing points, and vibrated by the same force, whether plucked or continuous, will give out the same tone. But when the force is variable, as a wind current, not only of changing velocity, but of different densities and velocities at different parts of the string, and the poles or bearing points yield under the changing stress, the wire gives out a ground tone, which rises and falls in accordance with the variability of motor and materials. Add to this tone the higher ones resulting from the string breaking into smaller divisions of vibrating length, and there results the peculiarly wild and uncultivated whining of the Eolian harp, which represents musically all that is uneasy, weak, and miserable.

Professor Tyndall's work "On Sound" gives with admirable clearness a full review of vibrating bodies, whether cords, rods, plates, or pipes.

Washington, D. C. C. W. CHAPMAN.

### The Mississippi Bridge at St. Louis.

MESSRS. EDITORS:—You have recently had several articles in regard to the progress of the great bridge across the Mississippi at this place. Difficulties unseen, or, rather, unexpected, which presented themselves in the sinking of the two channel piers, have been guarded against more effectually in the details and machinery of the abutment caisson, with the happiest results so far. Although this pier is much larger and must go much deeper than the east pier, the arrangements are so complete that the engineer experiences no anxiety about the abutment being safely placed on the bed rock of the Mississippi without accident of any kind. The rate of its descent during the last three weeks has averaged nineteen inches per day, thirty inches being the greatest day's work in that time. The masons have been laying stone night and day, eight traveling hydraulic purchases being used to supply the stone and mortar to them. The rate of descent named involves the laying of about 100 cubic yards of stone per day of 20 hours. The penetration of the pier is now 43 feet 6 inches below the surface of the river, 57 feet still intervening between it and the bed rock.

The operations at this pier have been suspended for the last three days, owing to extreme cold weather and the river being gorged with ice. The front of the pier stands out in the river about 100 feet from the Illinois shore, and the derrick pontoon or barge about 40 feet further. On this barge are 6 large steam boilers, 4 or 5 flues each, about 26 feet long and 44 inches in diameter, 2 steam engines driving air pumps, 2 ditto driving traveling purchases, 3 driving hydraulic rams, 8 hydraulic lifting jacks for hoisting stone, 5 large Cameron steam pumps to drive sand pumps, besides smaller ones for each battery of boilers (four in all). In fact this barge, *G. B. Allen*, is loaded down with a precious freight of most valuable machinery, and should she sink it would cause great trouble. To prevent this she is thoroughly bulkheaded into eight water-tight compartments, and a strong ice apron has been established above her to deflect and break up the ice as it comes down. This is now running so heavily as to thoroughly prove the apron to be a success, the ice being turned off from it like turf from the plow.

The river is so nearly blocked this morning that the ferry-boat can scarcely cross, even below the channel piers, and the ice is so heavy and moving so slowly that a close of the river is confidently expected if the cold continues many hours more.

The river is very low now, but I think it quite likely that 20 feet more will have to be worked through before getting down to the rock; this would give about 120 feet of water. Thirty working days will suffice to put the pier to the rock.

St. Louis, Mo. A. B. C.

Special Correspondence of the Scientific American.

## EASTERN LONG ISLAND---MENHADEN OIL AND THE FISHERIES.

SAG HARBOR, Dec. 9, 1870.

This is by no means the most pleasant season of the year to visit this end of Long Island, but business and pleasure do not always go together. This place, once one of the largest and most important of the whaling towns, now does almost no business in that line. Once they fitted out more than twenty good-sized ships every year, now two or three constitute the whole number.

The town has lately received some impetus from an extension of the Long Island Railroad to it, but it is hard for a seafaring population to learn new tricks. It contains one good-sized cotton factory, run by steam, and a large steam flour mill. Through the politeness of Mr. R. S. French I had an opportunity of seeing the place in its best aspect. It is much resorted to in summer, and its hotels are always crowded during the warm season. I could easily see the good one might derive from the sea breezes and recreation under the shade of the great elms around the Fordham House, or lolling lazily on a yacht floating down the bay.

The history of the cotton factory is that of too many similar institutions. As a corporation two distinct capitals were sunk; now it is in the hands of one man, and he makes it pay.

South of this place is the ancient town of East Hampton. With its venerable church, its cemeteries with their quaint old tombstones, its old-style houses, and good, honest old-fashioned people, not to speak of its excellent boating and fishing, and superb bathing beach, it has become not only a curiosity, but a favorite resort for hundreds of New Yorkers. A change is what the wearied city man wants, and in East Hampton he finds most emphatically the opposite of New York.

The Old Church is built chiefly of oak and juniper. There are timbers in it, perfectly sound, yet it is over 220 years since they were cut and hewed. The original church was built in 1649; this one was built partly of the old materials in 1717, and, unfortunately, somewhat remodeled in 1824. The frame is so strong that I think it would be possible to roll it over without starting a joint. The tie-beams are 8×10 inches and the rafters 8×4, with braces 6×4, and supports the same—all of hewn white oak.

The town is a singular place. It has one long wide street with a cemetery at each end, and there are not more than two or three modern styled houses in it. By far the greater portion of the houses are shingled on the sides, and are unpainted.

The power used for grinding corn, etc., is the old-style windmill. There are three in the village; one was running. We said to the proprietor, "Why don't you paint your mill house, your shingles will last longer?"

"Well, it's been here as it is for over seventy years, and I guess it won't hurt much more than it has."

The town is simply a well-preserved relic of more than one hundred years ago, and as such is well worth a visit. As we were leaving, about the only man we didn't find pretty near asleep hallooed out, "Tell the folks up in New York you found one live man in East Hampton, and that's Bill Gardiner." Asleep as they are, they are good farmers, good livers, and honest, hard-working people.

To this same live man we are indebted for much information about the menhaden fisheries. If the whale fishing has decreased the menhaden fishing has been found fully as profitable, and a much less dangerous substitute. The business was first commenced in Massachusetts. The first factory on Long Island was started about twenty years ago. The new style of oil did not sell well at first, but since the decay of the whale fisheries the business has grown into enormous proportions, and is immensely profitable. There are now about twenty factories on Eastern Long Island, and several in New Jersey. These hereabouts took last season about 70,000,000 fish. One seine caught during the season 1,500,000, and there is one factory which has the ability to take care of 200,000 per day.

The fish which are used for this oil-making is called "menhaden," "porgie," and "moss-bunker," and some say it is the same as the bony shad. The fish are caught in seines. Some of the men work on shares, each owning a part in a boat, and running risk of good catch, weather, etc. Some such, thus working, we were informed, made this year $1,053 each. Some of the factories own their boats and hire the men, others depend on buying. In the spring, when they first commence running, the fish sell for $2 per thousand, as they are poor then, and only yield about four gallons of oil to the 1,000. As the season advances they get better, and sell for $3 in the fall, and yield some as high as 18 gallons of oil per 1,000.

In making the oil the first are put in large tanks, and boiled with free stream; the oil and water are drawn off, and the residuum is pressed. This gives more oil of an inferior grade. The pummace is sold as fish guano for $20 per tun. It is an excellent fertilizer, and very generally used by the farmers of this section. It is also bought by manure-makers in New York and elsewhere, and mixed with phosphates, bone, and other less valuable matters. We think that mixed with a small quantity of ashes and a greater proportion of cotton-seed cake, it would make a first-class manure for the South. One manufacturer told me that he had made this year 1,800 tuns of this pummace. A great deal of it is now shipped South, and on Shelter Island there is a fertilizer factory which mixed it with Charleston phosphates.

Greenport is rather the headquarters of this fish and oil interest, and a large number of the factories are on Shelter Island opposite that place. The old frigate *Falcon* was some time ago purchased, and has been fitted up as a floating factory. The steamer *Algonquin* has lately been purchased for the same purpose. The object in having these floating factories is two-fold: if the run of fish is bad in one locality they can move; again, the smell from them is none of the pleasantest, and hence the inhabitants around the stationary factories frequently complain. That being the case near a floating factory they "up anchors" and move out of the way of injunctions.

This oil, the manufacture of which has become such a great interest to this end of Long Island, if well made, is a clear, bright-lemon color, sweet, and with but little fish smell or taste. Such oil, however, is rare, and sells at much higher figures than the ordinary grades—usual price 55 cents and 60 cents per gallon. There is, however, a great deal of very good oil made of a dark-lemon color, and from that to red. It is chiefly used for adulterating other oils and for manufacturing various patent or special lubricating oils. As an adulterant it is principally used in whale and tanner's oils. Well made it sometimes goes into low grade sperm. It has been put in linseed oil, but the cheat is there too easily detected, by simply dropping a little of the adulterated oil on hot iron.

It is one of the singular facts of our life experience, that wherever one of Nature's supplies becomes scarce, she raises up another to take its place. This fish interest is every year increasing, and we thought there might be a chance that all the little bunkers would be caught up, but some of the old fishermen told us they were more plenty than ever.

From these facts it will be seen that this business is one of considerable importance, and employs not only a large capital but many men. Greenport is the great seat of this industry, and every inhabitant is in some way interested in it. For the accommodation of the vessels engaged in it the United States Government has just ordered the erection of an iron lighthouse on the point of Shelter Island, just at the entrance of Peconic Bay. Both Great and Little Peconic and Gardiner's Bays are beautiful sheets of water, and much resorted to by yachtsmen in summer. Every island and spot of the shore is hallowed by reminiscences of our early settlers, and wild traditions of the Indian aborigines.

H. E. C.

[For the Scientific American.]

## WHAT CAUSES AURORA BOREALIS?

BY DANIEL KNODE WINDER.

In a recent letter, Mr. Proctor, F. R. A. S., remarks that "there is no generally received theory of the aurora." This, when we take into consideration the number of theories which have been proposed, is remarkable indeed.

A review of them indicates that there has been no lack of careful observations of the phenomena, and that very many of them have been correctly interpreted; and yet no theory is found adequate to meet all the requirements of the case.

Professor Loomis suggested that the light is produced by a current of electricity which flows outward from the equator of the earth, and inward at its poles; and Mr. J. E. Hendricks attributes it to a similar current of ether or air; and, although both are correct, they fail to give us an explanation of the way in which these currents cause the diversified phenomena.

In a recent number of the SCIENTIFIC AMERICAN, Professor Van der Weyde has demonstrated that interplanetary space is filled with a ponderable, but exceedingly rarefied medium. This, too, is certainly an important step toward a correct interpretation of the phenomena in question.

Why is it, then, that we are still left without the long-sought-for theory that will explain all the facts connected with the Northern Light?

I think the reason is that heretofore we have failed to recognize a number of well-established facts in regard to the nature of the forces—electricity, heat, and light. Believing this to be so, I determined to bring together all known facts relating to these forces, now generally believed to be correlated—and as the learned Tyndall has shown, but modes of motion—and having them before me to see if we should not learn more concerning their nature. With what success my labors have been rewarded, the scientific world will decide.

I am happy to say that one of the results which this letter is intended to present to the readers of the SCIENTIFIC AMERICAN, is a full explanation of the way in which electricity produces the diversified phenomena of Aurora Borealis.

Many established facts connected with the movement of electricity, heat, and light, have satisfied me that they are but one force, which is simply motion, undulating and progressive; and that the difference between them consists in the length and rapidity of their wavelets. I find, too, that force changes from waves of one length to another, and that the change results from the nature of the medium through which it is passing. The waves of electricity are shortest, those of heat longer, and those of light the longest, adapting them to the larger sizes of the molecules in a rarefied medium.

Let us now notice the changes in motion, as it passes from the sun to the earth. It exists in the body of the sun as electricity; in passing through the photosphere, owing to its insufficient conducting capacity, but a small portion retains its original form, and the excess is changed to waves of heat-length (this accounts for the heated condition of the photosphere of the sun), then, entering the rarefied medium which fills interplanetary space, it is changed to swifter and longer undulations, and in the form of light passes through space to the earth's atmosphere; there the resistance of air retards its waves to the form of heat, in proportion to the density, and passing to the earth, the force is changed (both light and heat) to the original form, electricity.

Now, I think we can explain the cause of auroral light. The currents flowing outward from the equator of the earth and inward to its poles, must increase motion in the molecules of the rarefied medium in the elevated region through which it passes; then, the property of diffusion, which force manifests, causes a flow to the surrounding molecules of atmosphere and to the earth. Now motion in that elevated region can only exist as light, and is the Aurora Borealis. But it must be remembered that it cannot be seen as luminous aurora until it enters the earth's shadow.

The upper edge of the dark bank beneath the luminous arch, in brilliant displays, marks the line along which the change from light to heat-length waves occur.

It may be said that the flow of the equatorial current being regular we should have aurora constantly. I reply that this is certainly true; but not in such quantity as to be visible, only at such times as there is more than ordinary flow of motion from the sun to the earth, which would correspondingly increase the equatorial flow of force. [The words motion and force are synonymous.] And it is the corresponding increase of the current inward at the poles of the earth that causes the agitation of the magnetic needle. Now, from this we may readily see the reason why the records of observations show a coincidence of the maxima and minima periods of sun spots, aurora, and magnetic storms.

When the auroral region is quiet, we have displays of steady light, but when disturbed by winds, or the inflowing current of air, there are dark spaces, by interruption of the flow of force, gently moving beams, or waving currents, while the grandeur is increased by reflection from masses of vapor always present during the displays.

Thus we see that the phenomena of Aurora Borealis are the results of the movement of electricity, heat, and light—the three forms of cosmical force.

Toronto, Ontario.

### Manufacture of Buttons.

The first manufacturer of buttons in this country was Samuel Williston. While he was dragging along as a country storekeeper—his eyes having failed him while studying for the ministry—his wife bethought her that she could cover by hand the wooden buttons of the time, and thus earn an honest penny. From this the couple advanced in their ambition until they had perfected machinery for covering buttons; the first employed for the purpose in this country. From this sprang an immense factory, and then others, until Samuel Williston made half the buttons of the world. His factories are still running at Easthampton, coining wealth for the proprietors, and known to every dealer in buttons the world over. He is now between seventy and eighty years of age, is worth five or six millions, and has given $400,000 to Easthampton for a seminary and for churches, $200,000 to South Hadley Female Seminary, and $200,000 to Amherst College, besides lesser gifts.

BEET-ROOT SUGAR IN CALIFORNIA.—The *News Letter* says: "No one article in all the notices of the California Beet Sugar Company begins to do the affair justice. We publish a few facts to correct the bungling misstatements made in the dailies during the past week. Two hundred and fifty barrels of A-1 sugar stands credited to shipment No. 1, with many more ready at mill to end over, and beets enough on hand to make two thousand barrels first-class sugar, besides second-class, sirups, etc. The mill, when running to its full capacity, will work fifty tuns of beets per day: they are now running through about forty tuns every twenty-four hours. They have one hundred head of cattle under cover to fatten on the pulp. The managers met with no difficulties in reaching the result they have, the parties engaged in the affair knowing their business. They owe no one, and, so far as we can learn, there is no stock for sale, except at a premium."

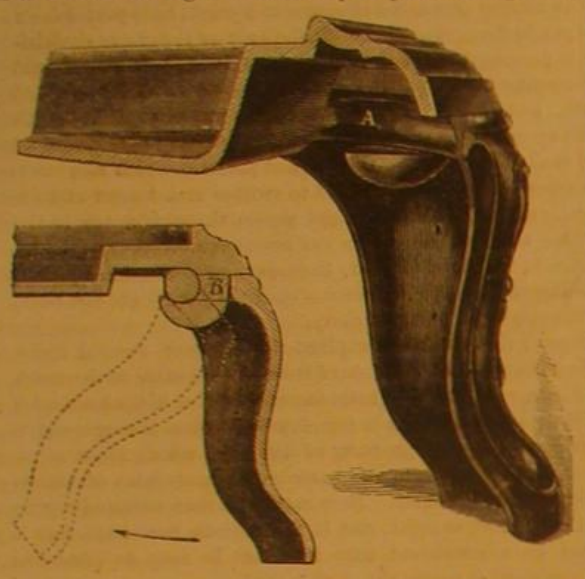
THE publishers of the *Shipping List*, contemplating a change in the mechanical department of their paper, offer their press, engine, etc., for sale. See advertisement in another column.

## IMPROVED SELF-LOCKING STOVE LEG.

A letter from one of our correspondents, published some time since in this journal, called attention to the unsafe character of the method of dovetailing stove legs. This letter called forth several others, which recounted accidents and narrow escapes from accidents resulting from the loosening of stove legs and the spilling of charges of burning coals, kettles of hot water, etc., whereby injuries of a severe character were in some instances received.

Several improvements in methods of fastening stove legs were suggested by the correspondence referred to, one of which is illustrated herewith. Two views are given, one being a perspective view and the other a sectional view.

It will be seen that the stove plate has cast thereon a stout hook instead of the usual dovetail. The hook fits into an eye in the upper part of the stove leg. That part of the eye marked A in the figure, is straight and has its vertical diameter longer than its horizontal diameter. To insert the hook or to take out the leg it is necessary to place the leg in the




position shown in dotted outline in the sectional detail. This requires the raising of the stove bodily from the floor an inch and one half or two inches. In no other way can the leg be loosened. So long as the stove rests upon it, it cannot be moved in any direction.

The hook on the plate is easily cast, the pattern being separated on the dotted line of division marked B. The body of the plate is first drawn, with the upper part of the hook, and the point of the hook is then picked out of the sand without trouble. We see no objection to this mode of constructing and attaching stove legs, while it affords ample security against the class of accidents above spoken of, without additional cost in the manufacture.

Patented Oct. 4, 1870. Address, for rights or other information, S. E. Chubbuck & Sons, 971 Tremont st., Boston, Mass.

## GUN COTTON.

Gun cotton is soluble in wood alcohol; one liter dissolves eighty grammes, but the solution is liable to change, owing to the production of formic acid.

The insolubility of gun cotton in nearly all liquids suggests its use for filtering sulphuric acid, chromic acid, permanganate of potash, caustic lye, solution of chloride of zinc, aqua regia, etc., and it is much employed for that purpose.

The Austrian method of making gun cotton for military purposes is as follows:

Cotton thread is twisted into yarn and then immersed for a few minutes in nitric acid, afterwards completely washed in water, wrung out, and dried at 129° Fah., and finally treated with a mixture of nitric acid of 1·52 specific gravity, and sulphuric acid of 1·14 specific gravity. Equal parts of these acids are taken and left to stand twenty-four hours after mixture, and the yarn is then introduced and left for forty-eight hours; it is then thoroughly washed in running water, immersed once more in potash soluble glass, and finally dried for use.

Gun cotton is now made into ropes for storage, and kept under water. When an order is received at the manufactory, a few hours suffice to dry it ready for transportation.

It has been found that by making the ropes with many air channels through the mass, the cotton explodes almost instantaneously, and is as violent in action as the fulminates. Charges for guns are now made into two parts—an exterior composed of cotton of loose texture, the ignition of which starts the ball, and an interior of denser material, which supplies the gas for accelerating the speed of the ball. The result is great gain in initial velocity.

Barnwell and Rollason's patent for new and peculiar products of gun cotton claims that rags can be employed instead of cotton. They make collodion in the usual way; to this is now added any of the pure animal or vegetable oils, and a new liquid is formed, to be used as a cement. Gums and resins afford a cement which may be rolled out into sheets and formed into cups, fancy boxes, etc. Oxide of copper imparts a green color, chloride of lime renders it uninflammable. It is recommended for dentists' and jewelers' use. The collodion oil can also be used as a varnish. Gun cotton reduced to a powder and mixed with niter and saltpeter, as a substitute for charcoal, makes a superior gunpowder.

J. Scott Russell says in his report, read in 1863, before the Mechanical Section of the British Association, that Baron von Lenk, of the Austrian Artillery, has discovered the means of giving gun cotton any velocity of explosion that is required by merely varying the mechanical arrangements under which it is used. Gun cotton in his hands has any speed of explosion from one foot per second to one foot in ·001 of a second. The instantaneous explosion of a large quantity of gun cotton is made use of when it is required to produce destructive effects on the surrounding material. The slow combustion is made use of when it is required to produce manageable power, as in the case of gunnery. It is plain, therefore, that if we can explode a large mass instantaneously, we get out of the gases so exploded the greatest possible power, because all the gas is generated before motion commences, and this is the condition of maximum effect. It is found that eleven pounds of gun cotton compressed into one cubic foot produces greater force than fifty to sixty pounds of gunpowder occupying the same space.

Gun cotton is used for artillery in the form of thread or spun yarn. In this simple form it will conduct combustion slowly in the open air, at a rate of not more than one foot per second. Some of the advantages claimed for this kind of gun cotton are:

CONVEYANCE AND STORAGE.—One pound of gun cotton produces the effect exceeding three pounds of gunpowder in artillery; this offers an advantage in transportation. It may become damp, and even perfectly wet, without injury, and can therefore be easily stored.

PRACTICAL USE IN ARTILLERY.—Gun cotton keeps the gun clean and requires less windage, and therefore performs much better in continuous firing; it also does not heat the gun as gunpowder does. There is less smoke, no poisonous gases, and the men suffer less inconvenience in firing. There is smaller recoil, greater velocity, and less weight of gun can be employed.

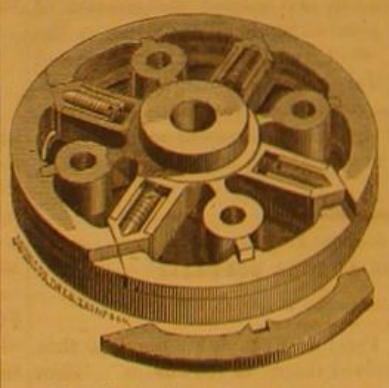
EXPLOSION OF SHELLS.—Shells are exploded into more than double the number of pieces, in consequence of the expansion of the steam and gases when the gun cotton is confined very closely in very small spaces. It is also a peculiarity that the stronger and thicker the shell the smaller and more numerous the fragments into which it is broken.

MINING USES.—Gun cotton is highly commended for this purpose, and is stronger than gunpowder, weight for weight, in the proportion of three to one in artillery, and six to one in solid rock. It is used for blasting in the form of a hollow rope, and after a little experience its splitting power can be regulated at pleasure.

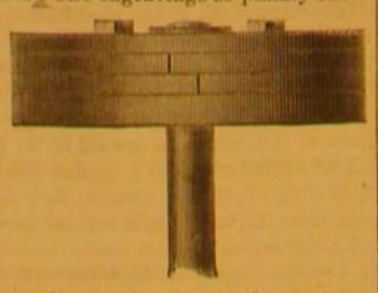
MILITARY AND SUBMARINE EXPLOSIONS.—It is a well-known fact that a bag of gunpowder nailed on the gates of a city will blow them open. A bag of gun cotton exploded in the same way produces no effect. The gun cotton must be confined; in a bag it is harmless; exploded in a box it will shatter the gates to atoms. According to actual experiments made in England, a small square box containing twenty-five pounds of gun cotton, simply thrown against the palisades of a fortification, will open a passage for troops, while three times the quantity of gunpowder would produce no effect whatever, except to blacken the piles. Explosions of gun cotton under water were found to be equally effective. A more detailed account of the uses of gun cotton and collodion must be reserved for a future communication.—*Prof. Joy in Journal of Applied Chemistry*

## CHUBBUCK'S PATENT PISTON AND PACKING.

The engravings accompanying this article show the construction of an improved piston and packing which have met with great acceptance for stationary and marine engines, and which possess the merits of simplicity and delicacy of action in a high degree.



The parts are all accessible for inspection, the weight is supported independently of the packing, the packing automatically adjusts itself to any slight taper there may chance to be in the bore of large cylinders, or any want of truth in the bore consequent upon strain, springing, or other causes; and and this self-adjustment is efficiently performed, even after the piston has been much worn by long use, while with minimum friction the join its thoroughly packed. The engravings so plainly show the construction of this piston and packing that a very brief description will suffice to make it clearly understood. The rings (two in number) are placed between two solid disks. The rings, instead of being continuous, are, after being turned true, cut into four segments, as shown, the cuttings being diagonal, as shown, and in an opposite direction, on one ring, from that of the other, so that when placed in position they shall break joints.



The method of cutting the rings leaves wedge-shaped recesses where the ends of the segments meet when placed in position, and into which the ends of radially expanding wedges are thrust by coiled springs acting in radial lines from the hub of a spider, as distinctly shown in the engraving. The expanding wedges run in guides, as also shown, and by their action on the segments of the ring, cause them to continually press gently outward against the sides of the cylinder, and thus taking up the inevitable wear, to keep the integrity of the steam joint unimpaired without excessive friction.

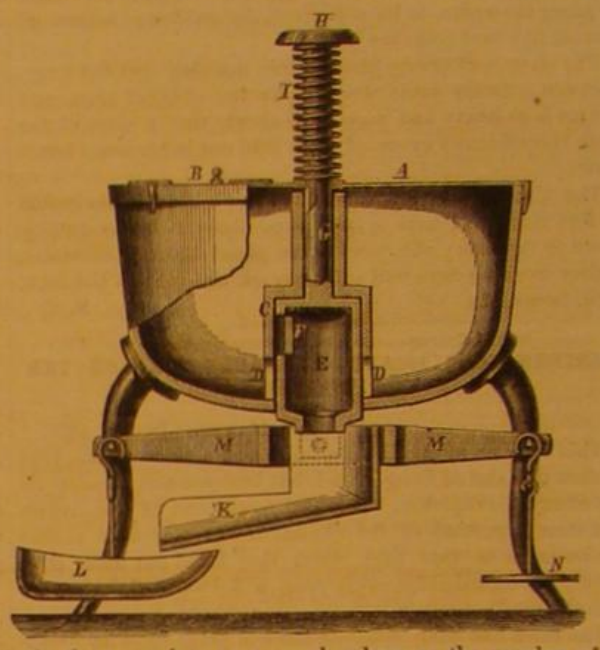
The device is also adapted to use as water packing in pumps, etc.

Patented February 28, 1868. Address for further information S. E. Chubbuck & Sons, 971 Tremont street, Boston Mass.

## BOOTON'S SHOT CASE AND DISTRIBUTER.

The object of this device is to supply to retail dealers a convenient case for holding the various sizes of shot, and also an apparatus whereby they can be conveniently weighed out in parcels as desired.

The body of the case is a metallic vessel, shaped like a kettle, and supported on suitable legs. Vertical partitions extending radially from the center to the shell of the case




divide the space into as many chambers as the number of different sizes of shot desired to be kept therein.

A circular cover, A, having a hinged door, B, formed therein, through which the shot are put into the case, extends over and closes the top of the body of the case.

From the bottom of the body rises a hollow cylinder, C, which cylinder communicates with the several chambers by apertures, D. Within the cylinder, C, is still another hollow cylinder, E, having an aperture, F, formed in it, and from the top of which rises a shaft, G, terminated by a knob, H. The lower part of the cylinder, E, protrudes through an aperture formed in the bottom of the case, and is held from falling by a coiled spring, I, which surrounds the upper part of the shaft, G, and expands between a collar attached to the center of the cover, A, and the knob, H. A feather is formed in the side of the shaft, G, which engages with the collar in the center of the cover, and turns the shaft, G, and the cylinder, E, about on their vertical axis, whenever the cover is turned; so that the cover and the cylinder, E, always occupy the same positions relative to each other.

The cover, A, being turned so as to bring the aperture, F, over one of the apertures, D, the hand placed upon the knob, H, presses down the shaft, G, and the cylinder, E, so that the aperture, F, is brought down over one of the apertures, D, and communication with the exterior of the case is established with the chamber inside the case to which the aperture, D, belongs. The shot in that particular chamber, then flow out into the cylinder, E, and thence into the chute, K, and thence down into the pan, L, of a balance, M; a suitable weight having been placed on pan, N, the hand releases the knob, H, as soon as the weight of the shot in L counterpoises the weight on N, and the coiled spring instantly raising the cylinder, E, into the position shown in the engraving, stops the flow. By raising the hand as the proper weight is approximated, the flow may be graduated so as to make it as small as may be desired, and to prevent any more flowing into the pan than will just turn the balance. An index, O, is attached to the cover, which, in connection with a suitable graduation in the side of the case, renders the turning of the cover to the proper number easy and certain.

Patented, through the Scientific American Patent Agency, January 3, 1871, by Sinclair Booton, whom address for rights and further information, care T. D. Johnston, San Antonio, Texas.

### Iron Around Peach Trees.

At a recent meeting of the American Institute Farmers Club, Mr. Wagner, who lives on Long Island Sound, about fifty miles east of New York, exhibited some pruning from his orchard to illustrate the effect of putting iron around trees. He took an old place with twenty trees in the orchard, full of dead limbs, with yellow leaves, and the crotches oozing thick gum. He gave the earth a good top dressing of iron, breaking up old plows and scattering the fragments. The effect has been marvelous. The trees have renewed their youth, and now look strong and thrifty. The bark is tight and leaves are green, and the borer has disappeared. He thinks the slag of iron furnaces, ground up and spread on orchards will prove a very valuable fertilizer for fruit trees of all kinds.

EACH of the scientific periods of time, except the century, simultaneously close with the year 1870, viz.: the decade year, month, week, day, hour, minute, and second.

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## WHERE IS THE LIMIT OF INVENTION?

Let one take up the Patent Office Reports, beginning with the first volume, and pass cursorily through them to the very latest, and he will, if not familiar with the number of inventions which are there recorded, probably be struck with astonishment, and rise with a feeling that after all this struggle for the complete mastery of the physical forces, there must remain very little to be done; that the field must have been worked nearly or quite entirely over, and that scarcely anything, in comparison, can remain for inventive talent to grapple with.

A closer and more rigid examination would, however, correct this mistake. Scrutinizing the character of each invention separately, he would find that by far the greater portion of even those entitled to be called useful, at the date of their devising, can, from the very nature of things, only remain useful till some advance in other departments renders them obsolete, and creates a want for other and entirely different appliances.

Besides this, each important invention is the parent of a large family of minor ones. See how numerous are the inventions which have been born of the application of steam as a motor. Governors, cut-offs, boilers, boiler feeders, high and low-water detectors, low-water alarms, steam whistles, valves, cocks, steam-engine indicators, apparatus for testing the strength of boilers, etc., etc., have been invented, each one of the classes specified or omitted including, we had well-nigh said, countless inventions of greater or less utility.

A discovery of means whereby electricity could be so cheaply employed as to exceed, or even to compete on equal terms with steam, as a motive power, would be inevitably followed by generation after generation of inventions, till the whole civilized world would teem with them. It would take a long time to cull out and count the inventions born of the Morse system of electro-magnetic telegraphy, yet this system is scarcely more than a quarter of a century old. The introduction of insulating cables for submarine telegraphy, and the extension of the system to very long distances, created a demand for more delicate recording apparatus, which, notwithstanding the large number of exquisitely ingenious devices created to supply it, is still unfilled.

"The eye is never satisfied with seeing, nor the ears with hearing." The human mind constantly feels a craving for something more than it possesses. Any creation of inventive genius which appeals to this craving is sure to be received with favor, be it nothing more than a sixpenny toy.

Looking at the progress of invention in this light, it will be seen that instead of approaching its ultimate limit, the field enlarges as we advance. In short, it has no limits. It is infinite as is the capacity of mankind to desire. We are all of us to-day longing for swifter means of travel and communication; for cheaper books; for more extended educational facilities; for more powerful instruments of scientific investigation; for fuller gratification of our tastes in the arts; and we are willing to employ, and keep employed, the creative genius which devotes itself to the supply of these wants.

Every announcement of a new discovery in chemistry or physics, heralds to the world the fact that a new "placer" has been opened, wherein rich veins of ore may perchance be found by the skilled inventor. When "oil was struck" in Pennsylvania, a few years since, who would have dared to predict the extent of the field it opened to inventive genius? No doubt the mechanical devices and chemical processes to which it has given birth may be numbered by thousands, and the improvement in the general welfare of the race, resulting therefrom, is simply incalculable.

No, the end is not yet; and it will never come so long as man remains constituted as at present. There are as many chances to win now in invention as there ever were, but it requires now higher qualifications for eminent success. The more inventions multiply the greater the necessity for higher standards of technical education, and the more general diffusion of theoretical as well as practical knowledge.

## THE PROFESSION OF THE MECHANICAL OR DYNAMICAL ENGINEER.*

The term "Mechanical Engineer" is a very unsatisfactory one, and its meaning is very indefinite. To some it conveys the idea of practical engineer; another will confine it to the profession of steam engineering, while the courses of study designed to fit young men for the profession of mechanical engineering are variously styled as "Mechanics and Engineering," "Applied Mechanics," "Industrial Mechanics," and "Applied Mathematics."

The necessity for a more accurate defining of the limits of the two great branches of engineering which in the terms "Civil Engineering" and "Mechanical Engineering" have had a very imperfect line of demarkation, has impelled the Sheffield Scientific School of Yale College to apply a new and more definite term, "*Dynamical Engineering*," to the chair of "Mechanical Engineering," in that institution.

In the inaugural address of Prof. Trowbridge, the reasons for the adoption of this term are given by him as including those we have already stated, and he adds that its indefinite character

arises from the fact that the term "*Mechanical*" is not employed in the sense which it would derive from the word *Mechanics*, as descriptive of a science of mathematically applied principles; but from the more restricted sense in which it is used to designate the work of construction of a machine, and the labors of the artisan or mechanic. It originated in the large machinery establishments, and at first referred especially to the manipulations necessary to produce and combine the material parts of a machine, rather than to the intelligent application of the laws of statics and dynamics, in designing and adapting machinery for the performance of specific work. In the sense derived from the word mechanics as a science, civil engineering is also a mechanical science; the only difference between this and mechanical engineering being that one is based on the principles of *statics*, and the other upon *dynamics*. These considerations would have little importance if the questions involved were merely those of words; but, as before remarked, they involve confusion of ideas, especially in the popular understanding of the subject. It has not always been deemed essential, for instance, that a mechanical engineer should be thoroughly acquainted with the *science* of mechanics, and his calling has been regarded as a trade or an art, rather than as a learned profession; as depending more on knowledge and experience in manipulations, or the labor of the hands and the use of tools, than on the exertions of the intellect.

We are glad that the new term "Dynamical Engineering" has been adopted, and think with Prof. Trowbridge that its singular appropriateness will be generally recognized.

In the address under review Prof. Trowbridge also makes some able remarks upon practical and theoretical instruction:

The practical course ignores books, and the study of the natural sciences. A boy on entering a machine shop is placed at some simple mechanical work, the use of the file, or chipping hammer, or lathe. In two or three years he may acquire experience in finishing the finer parts of machinery.

* * * * * * * * *

If he obtains a position in the drawing or designing room of such an establishment, he may acquire a knowledge of drawing, but his time is absorbed in making tracings and working drawings under the direction of superiors who have no time to impart general instruction in the fundamental principles of the work on which he is engaged. A shop, or machinery establishment is a business establishment, not a school of instruction, and it is rather a favor to young men, to allow them the limited privileges of such information as they may acquire through their own observations and experience.

Such a course may lead to a high degree of skill and excellence in the specialties of one establishment, but even in such a case the knowledge is gained by imitation. New problems even in that specialty—which involve new forms and dimensions—are apt to be discussed and solved by reference to the nearest example or precedent.

The instances of men who have reached an enviable degree of excellence by passing the first years of their training in the workshop are regarded as exceptional, and as resulting from peculiar qualifications of industry and application.

Theoretical knowledge as well as practical is necessary in order to avoid fatal errors. The only resource of practical men who are deficient in such knowledge, in solving new problems, is an actual trial involving expense and risk. On the contrary the young man who begins by a thorough course of theoretical study takes with him into his practice written experiences, deductions, and classifications, with a knowledge of an accumulation of facts which he could not acquire in a lifetime of practice.

The questions connected with the dynamical theories of heat employed as a source of power;—the propulsion of ships by steam, the movement of heavy railway trains, the raising of water, the construction of heavy steam and water-wheel machinery for rolling mills, forges and factories—all involving the movements of heavy masses, and the overcoming of corresponding resistances—are subjects which can be successfully treated only by the most rigid applications of the principles of mechanics.

This is a branch of the profession which no amount of practice alone, can reach. Sooner or later, every one who aspires to become a consulting engineer must devote himself to the study of the laws, theories, rules, and formulæ, which constitute this science.

Strength of materials and the proportions of parts to endure the strains to which they must be subjected are also subjects for the most rigid application of theoretical knowledge.

* Inaugural Address before the Sheffield Scientific School of Yale College, delivered Oct. 5, 1870. By William P. Trowbridge, Professor of Dynamical Engineering. New Haven: Printed by Tuttle, Morehouse & Taylor.

In the course of study which a young man desiring to enter the profession of Dynamical Engineering should pursue, the art of drawing is considered as of primary importance, though not by any means the most difficult accomplishment to acquire. Next in order is a sound knowledge of pure mathematics; next the science of mechanics, both independent of and in connection with its practical applications; and lastly a thorough knowledge of chemistry, physics, and metallurgy.

The fields of usefulness open to men possessing these qualifications are extensive and increasing, and the indirect benefits to be derived from the training of men in this way to take charge of the industries of the country will be felt in the increased economy of production, and the consequent reduction of cost in all that the necessities, tastes, and luxuries of modern civilization demand.

## THE MONT CENIS TUNNEL COMPLETED.

The readers of the SCIENTIFIC AMERICAN have been made familiar with the history and progress of this enterprise, which for thirteen years has been looked upon as one of the greatest of modern engineering feats; yet, at this time, a brief recapitulation will not be out of place, as telegraphic dispatches have announced the completion of the work.

It was, we believe, about the year 1830 when the tunnel was first talked of. In 1842, the king of Sardinia agitated the subject, and subsequently, under the encouragement of Count Cavour, its projectors appointed a committee of engineers to make preliminary surveys. In 1857 the work was commenced. At first, only the ordinary excavating tools—the pick, spade, and hand drill—were employed, and the work proceeded very slowly.

In 1861 a perforating machine was set to work on the Italian side, and in 1863, a similar machine was put in operation on the French side. No vertical shafts have been sunk; the work proceeded continuously from both sides till the two cuttings met. The cutting has been somewhat more rapid on the French side than on the Italian side.

The machines used were driven by compressed air, conveyed to them through tubes, and ventilation was also maintained by the aid of machinery. Gunpowder was at first used for blasting; afterwards gun-cotton was employed, and, finally, nitro-glycerin.

In 1862 the French Government agreed to defray half the estimated expense of the cutting (65,000,000 f.), in annual subsidies, provided it should be completed in twenty-five years, at the end of which time, should the tunnel remain unfinished, the French should cease to pay anything further. On the contrary, it was stipulated that if the tunnel was completed in ten years from June 30, 1863, the French should pay the full half of the estimated expenses. As the latter condition has been fulfilled, with two and one half years to spare, the French Government will now be held for its moiety.

The Mont Cenis Tunnel, which is eight miles in length, is the greatest work of its kind ever undertaken, and the success and rapidity with which it has been brought to its early termination is a triumph of engineering second to no other on record.

## PAVEMENTS.

Want begets supply. When the public become dissatisfied with what they have, and are fully decided as to what is really needed, nothing is surer, in these days of scientific and mechanical progress, than that somehow, by somebody, the need will be met. The public want better pavements. The public will certainly have them. The old cobble-stone pavements, "the car rattling over the stony street," are soon to be things of the past. What is to be *the* pavement? There is no more promising or more difficult field for inventors than this. The man, or the company, who can answer the question satisfactorily, not only does the world a great service, but opens a mine of wealth. Inventors know this, and rush into the field with almost the same eagerness of competition as wealth-seekers thronged to the gold diggings of California, or to the diamond regions of South Africa. New pavements multiply upon us. "Their name is legion." Each claims to be the pavement *par excellence*, but none has yet impressed the public as just the thing. It is not our purpose to discuss the merits of the different kinds of pavements, nor the claims which the inventors of each may put forth, but to call attention to the requisites of a perfect pavement. We have before alluded to this subject, and we return to it for the reason that those who are working in this direction seem almost invariably to lose sight of some feature indispensable to permanent success. And here a remark or two upon the word success may not be out of place. Success in making large profits through corrupt "jobbists" is one thing; a success in a mechanical, scientific, utilitarian point of view is quite another. In the former sense we have had many successes; in the latter sense, as yet, none. We do not mean to say that we have not pavements possessing some of the essentials, but we do mean to say that there has been no pavement extensively laid for which any close student of the subject will venture to predict universal use, or anything like it, say fifteen or twenty years to come.

Let us seek to enumerate the essentials, and let each inventor consider for himself whether his particular device or combination provides for or meets them.

1st. Durability. Not merely sufficient to withstand a few years' wear in some fashionable avenue, frequented for the most part only by carriages, but sufficient to justify adoption in our most thronged and roughly-used business thoroughfares. It may be claimed, with show of reason, that we may have different varieties of pavement for different localities, but it will certainly be conceded that a pavement for which streets adapted to its endurance must be selected cannot claim to be perfect.

2d. Cheapness. We mean cheapness in the true sense of the term. That is not always the cheapest which costs the least. If there is any matter in which a city may be "penny wise and pound foolish," it is just this matter of pavements. That is truly the cheapest where the purchaser gets the greatest possible return for the expenditure. Viewed with reference to durability alone, other things being considered as equal, that pavement is the cheapest with which it costs the least, interest and repairs included, to keep a street paved, and which exacts the least from teams and vehicles compelled to use it. To illustrate by an extreme: A pavement that would last forever—supposing such a thing possible—would be dear at sixteen dollars per square yard, as compared with an equally agreeable pavement, lasting eight years, at five dollars per square yard; for the interest on the difference of cost would more than renew the pavement every eight years. The pavement, no matter how good, should not exceed in cost our present improved pavements, say five or six, or at most, for the severest streets, like our Broadway, seven or eight dollars per square yard. This, of course, does not include bonuses to jobbing city officials, for a pavement possessing all the requisites would fight its own battles, and ultimately compel its own adoption, and not be under the necessity of buying its way into public favor.

3d. Permanent abundance of material. We say *permanent* abundance, for, no matter how good a pavement may be, constructed of a material the supply of which is limited, or must in a few years become so, such an one cannot be the pavement of the future.

4th. Evenness of surface. This essential hardly needs remark. The jolting, rattling, and rumbling, and wear and tear on horses and vehicles, of our present stone pavements, are nuisances no longer to be borne, and it is marvellous that they have been tolerated so long.

5th. Sure foot-hold for horses. Neither those who own horses nor those who have any sensitiveness to the sufferings of these much-abused and useful animals, will favor a pavement upon which horses are constantly slipping, straining, or falling.

6th. Noiselessness. This follows, of course, from evenness of surface, which must be combined with a certain degree of uniform roughness to meet the 5th requisite—sure foot-hold.

7th. Rapidity of construction, so that the street may be impeded for the shortest possible time. The pavement should be completed at the rate of a block, or nearly so, per day, and each block be thrown open to the public on the day following its construction.

8th. Facility of repairs. For the sake of an illustration, we have supposed a pavement lasting forever; but pavements do *not* last forever. It would seem that a pavement which could be laid with facility ought naturally to be repaired with facility; but this does not follow. Some of our improved pavements cannot be repaired without keeping the block, upon which the repairs are made, closed for days for the repaired portion to harden, and some cannot be *perfectly* repaired at all.

9th. Freedom from dust. That is, freedom from dust arising from the pavement itself, which follows naturally from durability; for dust of the pavement proper is caused by pulverization under attrition of hoofs and wheels, and if a pavement wears slowly it makes but little dust. Freedom from dust arising from droppings of animals, etc., is only attained by sweeping, and the surface should have such a kind of roughness as to be easily swept, possessing no deep crevices, or places for the permanent lodgment of filth.

10th. Dryness. There should be nothing of an absorbent nature in or about a pavement, because moisture absorbed into the pavement renders it subject to the action of frost, and, in a sanitary point of view, certain to become impregnated with impurities, making it both offensive and unhealthy.

We have purposely left out of our enumeration of requisites one frequently mentioned, and by some considered indispensable, viz: facility of taking up for the purpose of repairing or constructing sewers, gas pipes, water pipes, etc. Such facility at the present time is desirable, but for the future it is not indispensable. The subterranean work for cities will ere long conform to the pavements, and be so constructed as to be reached without disturbing them.

It would not be deemed wise to build houses with reference to digging and repairing cellars under them afterwards, and it is but a little better policy to construct streets with reference to tearing them up. We do not pretend to say what material, or combination of materials, or what device, or contrivance for using them, are to meet all the conditions which we have enumerated. The material most abundant, and thus far most extensively used, has been stone. Yet no form of stone pavement has, up to the present time, proved satisfactory. All have been either uneven and noisy, or, if smooth, so slippery as to be at times inconvenient. The most agreeable form of stone roadway extensively used is the form commonly known as the McAdam, or broken stone road. And yet a street paved with broken stone alone would not answer the purpose, for the reason that it is not impervious to water. Yet we venture to suggest—and inventors may take the suggestion for what it is worth—that if broken stone could be held together by some kind of cement of sufficient tenacity and durability to hold the stones in their places till worn out, and render the wood impervious to water, and if a pavement thus composed could be made to meet the requisites of cheapness and rapidity of construction, it would, perhaps, approach very nearly to the requirements of the coming pavement.

A VEIN of block coal, forty-seven feet in thickness, was recently discovered near Alamo, Ind. A company of Pennsylvania capitalists have, it is said, offered one million dollars for it, but have been refused.

## AIR LIGHT.

What has become of the air light about which so much was said a few years ago? This light belonged to the class where an oxide is rendered incandescent, and hence powerfully luminous by the heat of a burning jet of mixed gases. Instead of using oxygen and hydrogen, it was proposed to compress illuminating gas into cylinders and to employ atmospheric air also under pressure, but previously superheated. The air contains one part, or 20 per cent, of oxygen, and four parts, or 80 per cent, of nitrogen; hence it would require four or five parts of air to give the requisite quantity of oxygen; that is, to obtain one foot of oxygen, five feet of air would be needed, as four of them would be nitrogen.

It has been proposed to remedy this difficulty by passing the air through water under pressure, and freeing it of a large part of its nitrogen, as that gas is not so soluble in water as oxygen. But this would involve expensive apparatus. If the nitrogen could be prevented from carrying away the heat from the jet at the point of ignition, the air would give us all the heat and light required when burnt in combination with illuminating gas. To prevent the nitrogen from conducting away the heat the air must be previously superheated in furnaces and fed hot to the burner. Some of the locomotives on the New York Central Railroad were at one time supplied with head-lights composed of four compound jets, encircling a small pencil of lime. A current of air and of gas was conveyed to each jet, and by a simple device the air was heated before reaching the jet. The flow of gas was controled by simple regulators and stop-cocks within the lamp. Two gas holders, placed under the engine, communicating with the lamp by a small pipe for each, were constructed to carry two or three times the requirements of a trip. The air was superheated by being passed through the fire-boxes under the boilers without additional cost. The engineer who explained it to us pronounced it a perfect success, but that was several years ago; since then we have heard nothing of it, and so repeat the question: What has become of the air light?

## WASTE LIQUORS OF PAPER MILLS.

The American Wood Paper Company at Manayunk, Penn., have introduced an important feature into their works in saving the waste alkali solutions. It is said that eighty-five per cent of the original alkali employed is recovered. The spent liquor is conducted from the pulp boiler into a suitable reservoir, where it is pumped up into evaporating furnaces. These furnaces are constructed according to a patent granted to Messrs. Keen & Burgess in 1865. They are of great length and radiate from the center of a building resembling a locomotive shed, and all communicate with one central chimney. A powerful draft carries the hot gases of combustion over and under the evaporating pans, and the water is thus rapidly carried off. The alkali is finally transferred to the calcining furnaces, where it is brought to a condition suitable for mixing with a fresh portion, preparatory to being used again. In the manufacture of paper from straw the stock is also boiled in caustic soda lye under pressure, and in most establishments the impure black liquor is thrown away. The soda extracts silica and gluten from the straw, and thus forms a very weak and impure soluble glass. It has been proposed by some manufacturers to evaporate the solution and economize the soluble glass and the extra alkali, but the expense of the evaporation has deterred most of the larger establishments from attempting to make the saving. It would be well for such paper manufacturers as deal in large quantities of alkali, to try the Manayunk process described above. If soda were a substance that could be thrown down from a solution by precipitation, it would be an easy matter to save it, but unfortunately there is no reagent with which it can be combined for this purpose, and we are compelled to have recourse to evaporation. The use of the spent alkali for agricultural purposes has been tried, and if potash had been employed instead of soda the results would be favorable where the expense of transportation did not destroy all the profit, but as soda is now considered by many authorities as actually deleterious to the growth of plants, this application of the spent alkali of the paper mills cannot be recommended. The soluble silica would be of great value in agriculture if it could be separated from the alkali, but this separation is not feasible. There is no reason why the lime used in the vats to render the soda ash caustic should not be put upon land, and such a disposition of it is made at many country mills.

If any of our readers can give us additional information on this subject we shall be glad to make room for their communications.

## SPIRITUALISM AND SCIENCE.

Two of our correspondents exhibit a commendable desire for information in reference to the movements of tables by invisible spirits, and as one of them appears to have been severely handled by some of the evil kind, we do not wonder that he seeks for an explanation of the phenomenon.

If there is anything established in nature, it is the invariableness of her laws. The laws which regulate the material world are beyond all reach, and the Creator never permits the management of the universe to pass out of his own hands, or to be interfered with by any of his creatures. The moment we deny this, that moment science becomes impossible. For ages the belief obtained that angels and demons were able to control or influence physical laws. As long as such superstition prevailed, scientific progress was impossible. It was only when it was discovered that the laws of the physical universe were fixed and sure that men were encouraged to carry on scientific research, for they then knew for the first time that if they asked for bread they would not receive a stone.

The physicist now knows that to move a table without the aid of muscular or mechanical force requires a suspension of the law of gravitation, and he also knows that the momentary suspension of this law would reduce the whole universe to chaos and destroy the equilibrium of matter. To suppose that any spirits have such power as this is impious and irreverent in the extreme. None but the Divine Spirit can act on matter except through the medium of matter, and to ascribe such power to any of God's creatures, whether in the flesh or out of the flesh, overthrows all that religion and science have taught us. Hence the scientific man never believes in any apparent infraction of the laws of the universe. He knows that the phenomenon observed is due to natural causes, and goes to work to search out the mystery. There are plenty of known causes which have always been in operation, that are quite sufficient to produce all of the genuine results of spiritual manifestation without the necessity of appealing to the supernatural for an explanation, and Dr. Hammond has shown us that there are other causes which explain why honest people may conscientiously believe in the genuineness of all these manifestations.

We have recently given a series of articles on the history of attempts to invent a perpetual motion. The physicist is absolutely certain that a perpetual motion *accomplishing work* is an impossibility according to the known laws of mechanics, yet the attempt to construct such a machine has been made for centuries, and no doubt will continue to be made as long as the world stands.

If a party of true believers in spiritualistic manifestations could seat themselves by the side of a stream of water and make it run up hill, they would accomplish a much more clever trick than to chase a table up stairs or out of the window, as your genuine spiritualist will not hesitate to do for you at any time; but as it is difficult to take hold of the particles of a liquid, this particular form of exhibition is never attempted, and making water run up hill is chiefly confined to a vulgar force pump.

Many of our readers have no doubt witnessed the performances of necromancers, and have gone home greatly puzzled and wholly unable to explain what they had seen. We recollect to have seen a cane set upright on a floor and a lad balanced horizontally upon it. There was nothing particularly wonderful about this, but when the cane was taken away, without the lad's falling, and it was passed over, and under, and all about him, so as to show that he was not supported by wires from the ceiling or by rods from the floor, we had no ready way for accounting for it, but were absolutely certain, from our knowledge of the fixity of all physical laws, that there was some trick by which it was done, not visible to the senses. Aristotle believed that the heavenly bodies were suspended by invisible cords, otherwise they would fall upon the earth and crush it. He was evidently no spiritualist, but a believer in the necessity of something tangible to hold up the stars.

Some of our correspondents complain that scientific men will not examine into the phenomena of table-turning and give us an explanation upon a physical basis. They forget that this has been done by the highest authorities in this country and Europe.

In 1859, in the city of Boston, a reward of five hundred dollars was offered, through the columns of the *Courier*, for a satisfactory exhibition of some of the ordinary manifestations which mediums of every degree were constantly pretending to produce and which were fully believed in by the faithful as of spiritual origin. The challenge was accepted by a spiritual corps consisting of Dr. H. F. Gardner, Mr. Allen Putnam, Mr. Alvin Adams, Major Raines, Miss Kate Fox, and others, and Professors Peirce, Agassiz, Horsford, and Dr. B. A. Gould, were appointed a committee to give them a fair trial. It is hardly necessary to say that the whole thing was an utter and complete failure, although the distinguished professors displayed the utmost candor and patience in their search for the truth, just as they would have done in any other scientific investigation.

In England the late lamented Professor Faraday subjected the phenomena of table-turning to a most searching investigation. The report of his experiments has been extensively published and ought to be regarded as conclusive by the most skeptical inquirer. Our readers will find it in *The Athenæum*, page 801, for the year 1853.

Professor Faraday by an ingenious device found a way of measuring the direction of the force by which the table was moved and showed that the movement of the muscles was involuntary. Whenever an index was attached to the table which made the least motion visible to all, there was no effect, because the involuntary feature was destroyed and the parties to the transaction could not exert the force required for lifting it excepting in the ordinary way, and such table lifting would be like moving furniture about the room in the most humdrum style. The experiments were a perfect demonstration of the muscular origin of the table moving, and must be admitted as such by any one possessed of sufficient capacity to understand them.

There is no doubt that rappings and tippings were known to the Romans, and they were re-discovered, so far as this country was concerned, at Rochester, in 1846. Since that date we have had a surfeit of them, and it has now become a regular business, as much so as selling groceries or giving exhibitions with the magic lantern. The tricks of the trade have been exposed over and over again, but the world will be deceived by them in spite of all the warnings that we or the daily papers can give. We must look to our schools to correct the evil by the dissemination of accurate scientific information among the people.

## ALLOY OF LEAD AND PLATINUM.

Most beginners in the laboratory have involuntarily made an alloy of platinum and lead by attempting to fuse lead in a platinum crucible, and finding to their dismay the bottom falling out.

Professor Bauer has subjected the alloy to a scientific investigation. He prepared an alloy by fusing three parts of lead and one part of platinum, which was so brittle that it could easily be pulverized in an agate mortar. This was moistened and exposed to the action of carbonic acid until a considerable portion of the lead was converted into the white carbonate, and there was no longer any action.

The residual alloy from this experiment was subjected to analysis, and yielded:

| | Analysis. | Calculated. |
|---|---|---|
| Platinum | 45·86 | 48·82 |
| Lead | 50·97 | 51·18 |
| | 99·83 | 100·00 |

This would give the formula P + Pb. The alloy of platinum and lead prepared in this way is a crystalline, brilliant, steel-gray powder, which is easily decomposed by mineral acids, but remains unchanged in dilute acetic acid. When heated it fuses easily to a brittle crystalline mass, resembling bismuth. Heated in a current of air the lead oxidizes, and can therefore be removed in a muffle.

The specific gravity of the alloy is 15·77 by calculation; it ought to be 16·15. This method of preparing the alloy of lead and platinum may have application with other metals, and Professor Bauer is now occupied with that branch of the subject. It has been hitherto supposed that an alloy of lead and platinum could not be kept any length of time without changing into white lead and platinum powder. The new researches show that a permanent alloy can be made in the way above indicated.

PLANTS of the cactus family are principally confined to the Western continent, and although most abundant in tropical regions, some forms extend far into the temperate zone, and some species even have an alpine character. Back, in his northern expedition, saw with astonishment the banks of the Rainy Lake, in latitude 40° 40′, entirely covered with the prickly pear (*Opuntia vulgaris*). Humboldt found on the Andes several species of cactus on elevated plains from 9,000 to upwards of 10,600 feet above the level of the sea. Some have even been gathered at an elevation of 13,600 feet. In size and hight the different kinds present remarkable contrast. In Mexico and Arizona many kinds assume an arborescent form. Other kinds have a globular form, some with a dia meter of three feet, and attaining a weight of 2,000 pounds while a cactus in South America is so small and so loosely rooted in the sand that it gets between the toes of dogs.—*Entomologist.*

STUDY OF NATURAL HISTORY.—For many years it has been one of my constant regrets that no schoolmaster of mine had a knowledge of natural history, so far at least as to have taught me the grasses that grow by the wayside, and the little winged and wingless neighbors that are continually meeting me with a salutation which I cannot answer, as things are. Why didn't somebody teach me the constellations too, and make me at home in the starry heavens, which are always overhead, and which I don't half know to this day? I love to prophesy that there will come a time when, not in Edinburgh only, but in all Scottish and European towns and villages, the schoolmaster will be strictly required to possess these two capabilities (neither Greek nor Latin more strict), and that no ingenious little denizen of this universe be thenceforward debarred from his right of liberty in those two departments, and doomed to look on them as if across grated fences all his life!"—*Carlyle, in the Edinburgh Courant.*

THE arborescent grasses constitute one of the most beautiful adornments of tropical vegetation. These grasses belong chiefly to the *Bambusa* (bamboo) and other related genera. In India the seeds of the bamboo are mixed with honey and eaten like rice. In South America an arborescent grass, the gigantic *Guadua*, attains a hight from 50 to 60 feet. Another species, a powerful climbing grass, twines around the trunks of large trees, reaching to their tops. A species of cane (*Arundinaria*) grows in large tufts, reaching a hight of 30 to 40 feet, of which the first joint rises without a knot to a hight of 16 feet before it begins to bear leaves. These joints being hollow, are used as blowing tubes by the Indians, for the discharge of their arrows. Even in the Southern United States the stalks of *Arundinaria* furnish fishing rods of the best description.

A SAN FRANCISCO undertaker claims to have discovered a new method of preserving the dead human body. By his process he petrifies it. He exhibits a body that he petrified in July, 1868, and it shows no signs of decay. When struck, says the editor of the *Morning Call*, it gives out "a ringing, metallic sound." The color of the flesh is not changed. All this is very wonderful, if true, but it is of questionable utility so far as the human body is concerned.

BELGIAN RAILS.—In the first eight months of this year Belgian rails were exported to the extent of 93,889 tuns, against 103,746 tuns in the corresponding period of 1869. There was a considerable increase in the exports of Belgian rails to the Zollverein, France, and Spain, but a decrease occurred in the exports to Russia, the Low Countries, Turkey, Italy, and the United States.

## SCIENTIFIC AMERICAN.

### 1871.

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SAMUEL COLT,.....Inventor of Revolving Fire-Arms.
CHARLES GOODYEAR,.....Inventor of Rubber Fabrics.
FREDERICK E. SICKLES,.....Inventor of Steam Cut-Off.
HENRY BURDEN,.....Inventor of Horse-Shoe Machine.
JOHN ERICSSON,.....Inventor of the first Monitor.
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PETER COOPER,.....Inventor of Iron-Rolling Machinery.
JOSEPH HENRY,.....Inventor of Electro-Magnetic Machine.
ISAIAH JENNINGS,.....Inventor of Friction Matches.
RICHARD M. HOE,.....Inventor of Fast Printing-Presses

These noble men, by their own efforts, raised themselves from the depths of poverty, and by their wonderful discoveries, conferred incalculable benefits upon the human race, entitling them to rank among its greatest benefactors. It is but fitting that the remembrance of their achievements, and the honored forms of their persons, as they lived and walked among us, should be perpetuated by the highest skill of art. The picture, which is three feet long and two feet high, forms an enduring and desirable object for the adornment of the parlor. It was engraved by the celebrated JOHN SARTAIN, from a large painting by SCHUSSELE, and all the portraits were taken from life. Every lover of Science and Progress should enjoy its possession. Single copies of the Engraving $9; Three copies, $25.

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## Queries.

*[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers, and hope to be able to make this column of inquiries and answers a popular and useful feature of the paper.]*

1.—WHITE VARNISH FOR PAPER.—I wish a recipe for a white varnish for heavy paper that is white when applied, and will remain white after it is applied, and dry perfectly hard in a week after application.—J. D. B.

2.—CEMENT.—I wish a recipe for a cement to fasten chamois and other leather to iron and steel.—F. P. B.

3.—BLUEING PISTOL BARRELS.—I can form a blue on iron or steel by heat, but I am told the beautiful blue color on fine pistols is produced by acids and not by heat. Will some one inform me of the true method employed?

4.—PAINT FOR GALVANIZED IRON.—What is the best paint for priming galvanized iron so as to make a durable job?

5.—MAGNETIC PROBLEM.—Suppose two iron plates or disks of definite size to be placed one eighth of an inch apart, and then to be connected with battery poles, so as powerfully to attract each other. If now one of the plates be made to revolve at definite speed, will the attraction be diminished, and if so in what ratio to the size and speed of revolution of the plates?

6.—TO EXTRACT OIL FROM OLD BELTING.—How can I extract the oil from old belting, particularly sewing machine belts, so that they can be used again?—C. W. L.

7.—WHITENING DIALS OF STEAM GAGES.—How are the dials of steam gages and the scales of barometers whitened so as to present their peculiar frosted appearance?—M. C. H.

8.—TEMPERING JEWELERS' TOOLS.—How can I temper jewelers' tools, such as drills, small engravers, etc.? What color should they be when tempered? Also I wish the name of some instructive work on jeweling.

9.—CEMENT—GALVANIZING CAST IRON.—Will any of your million readers tell me how to make a cement that, when hard, looks like cast iron filed, and which will stand a moderate degree of heat? I would also like to ask of some one posted how to galvanize a deeply corrugated cast-iron surface which is not very large or cumbersome, the main point being to put it on very smoothly, and whether the piece to receive the coat is to be first heated?—M. H. K.

10.—SUBSTITUTE FOR PAPER.—What article can be obtained which can be written and printed upon and rolled up like paper, but stronger, and which can be had of indefinite length?—G. B.

11.—RENDERING BRICK FLOORS IMPERVIOUS TO MOISTURE.—The floor of the lower story of my house is laid in brick with a thick coat of Rosendale cement which is not impervious to moisture. What is the most economical way of preventing dampness from coming through and rotting the carpets?—J. M. K.

12.—PASTE.—What is the best recipe for paste to firmly attach strips of cotton cloth to stiff colored paper without leaving the parts pasted together much more rigid than the paper itself?—J. W.

13.—MILLSTONES FOR GRINDING CORN AND FEED.—Will some of your millwright readers inform me what sized burrs, kind, etc., shall I purchase for grinding corn and feed? I have a 10-horse power engine, and wish a mill that will suit such power. Are any of the patent mills or iron mills any improvement upon the old-fashioned French burrs?

**Facts for the Ladies.**

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## Answers to Correspondents.

*CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.*

*SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1 00 a line, under the head of "Business and Personal."*

*All reference to back numbers must be by volume and page.*

SOLDERING SPRING WIRE.—J. E. W. asks how to solder spring wire with hard solder. In watch making I have often made brass and steel tongues, soldered them to the joint with hard solder, and left them in an elastic state. Steel wire may be tempered in the usual manner after soldering, but we usually treat it the same as brass. After soldering the temper is restored by hard rubbing with a burnisher, which condenses and hardens the wire in the same way that hammering or milling does a plate. Brass, gold, copper, or silver, should be treated with dilute oil of vitriol after soldering, to destroy the oxide and the compound of oxide with borax or other flux used. Steel or iron should never be put into vitriol.—J. T. L., of S. C.

HEATING SURFACE OF STEAM BOILERS.—W. V B. is running an engine developing, according to his statement, 107-horse power, while his locomotive boiler, allowing 6 square feet of heating surface per horse-power, develops only 50-horse power. Two cylinder boilers, 30 inches diameter and 40 feet long have 323¼ feet of heating surface; and as a much greater proportion of fire surface is required per horse-power in a cylinder boiler than in a locomotive boiler, the two cylinder boilers would not generate steam faster, perhaps not as fast as through the locomotive boiler, and therefore could not supply steam enough to run the engine under the conditions specified.—W. M. M., of Mich.

BOILER CAPACITY.—If the two cylindric boilers referred to by W. V. B., be well set and covered in, say 6 inches above their centers, they will present 400 square inches of surface to the fire, and ought to give 40 to 45-horse power of steam to the engine mentioned, if the steam be properly utilized in the cylinder. We have obtained 55-horse power with a 15 x 36-inch cylinder, with plain slide valve, the steam being made in three 36-inch diam., 30 feet plain cylinder boilers fired with shavings and sawdust. The difficulty with the locomotive boiler is lack of effective heating surface. Not more than half the surface of the tubes, owing to soot and ashes, being available for transmission of heat.—J. H. C., o Pa.

WIRE OF SOLDER.—E. E. D. can make solder in the form of wire, as follows: Take a common ladle used for melting lead, and drill a small hole one half inch from the brim opposite the nose. Melt the solder so that it will run easy through the hole, and as it runs out, draw the ladle along over some smooth surface, such as a saw plate or the face of an anvil. If done properly it will run in the shape of a thin wire as long as the surface you run it on. This is the only way I think it can be done. The right of making solder wire this way was purchased from a peddler, who went round the country selling the wire to jewelers.—C. H. G., of N. Y.

CALCULATING HEATING SURFACE OF TUBES.—W. V. B. should calculate the heating surface of tubes from the inside.—G. M M., of N. J.

L. J. K., of N. Y.—The conventional tints for the various materials represented in mechanical drafting are variously prepared. We prefer Johnson's formulæ to any other. According to these formulæ, stone is represented by a light dull yellow, made by mixing a little India ink with Roman ochre. For brick use a light red, made of vermilion, brightened by a little carmine. For steel or wrought iron a light shade of Prussian blue, a trifle lighter for steel than wrought iron. For cast iron use indigo, with a little carmine added, or Payne's gray. For lead and tin use the same color as for cast iron, with the addition of a small proportion of India ink and carmine. For copper, use pure carmine or crimson lake, with a little burnt sienna added. For brass or bronze use burnt ochre or a mixture of gamboge with vermilion, or simple gamboge. If the mixture of gamboge and vermilion be used, it must be kept constantly stirred, or the colors will separate. For wood use burnt umber, or raw sienna. For leather use a light tint of sepia; for gutta-percha a darker tint of the same, and for vulcanized rubber, use sepia with a little indigo added.

A. H., of Ohio.—The word power is used in two senses. In the modern use of the term it means the ability to perform work as measured by foot-pounds of resistance overcome in a definite time. In this sense the term is general in its signification, and has no reference to any particular resistance to be overcome. It is in this sense, doubtless, that Mr. Craik uses the word in the article on "Fly and Balance Wheels," published on page 403 last volume, and to which you take exception. In the old saying, "What is lost in speed is gained in power," and *vice versa*, the word power is used in a special sense, meaning ability to overcome a particular resistance, as, for instance, a particular weight to be raised in mass. Mr. Craik makes no claim in his work to literary merit, and perhaps fails to express himself perfectly in the passage cited. We understand, however, his meaning to be what we have stated, the expression "loss in power" probably referring to consumption of power through friction, etc.

L. I. O., of Minn.—From your description we judge your ice-house leaks air at the bottom, either through the drain pipe, (is there a trap in this pipe?) or through unstopped crevices. Such crevices would cause a downward draft of warm air through the open ventilator at the top, and cause the melting from the top and sides of the ice of which you complain. If you must use an open ventilator at the top to keep the articles stored in good condition, you must be careful to stop all the air holes at the bottom.

A. B. S., of Pa.—The simplest and most common way of making U-magnets, is to forge the steel bars into the proper shape, harden, and then place them with their poles together, in such a way that the poles which are to be of opposite names shall come together. They are then rubbed with a strong horseshoe, or U-magnet, placing the latter in such a way that its north pole is next to the south pole of one of the new magnets, and its south pole next to the north pole of the same new magnet.

J. D. O. C.—It is not necessary that drawings intended to illustrate a work on carpentry should be as finely executed in the manuscript as they are intended to appear in the work itself. The artist, if he knows his business, will be able to execute them properly, provided they are intelligible.

J. T. L., of S. C.—Your query in regard to weights and cords is not sufficiently explicit. Do you mean a cord attached at both ends, or only at one end?

J. G. M., of ——.—There is no known solvent for the diamond. Evaporation is a widely different process rom dissolving. Consult your dictionary on the meaning of these terms.

C. H. S., of ——.—In the absence of our regular proof reader last week, an error occurred in the answer to your query. It should have read: The Torricellian Vacuum, formed by inverting a tube filled with mercury in a cup containing the same metal, is not perfect. Good authorities maintain that no perfect vacuum can be produced.

J. S., of R. I.—For siliceous silica, in the answer to your query published last week, read *infusorial* silica.

T. T. O., of Ill.—For rules to calculate dimensions of safety valve, lever, etc., consult Bourne's Hand Book of the Steam Engine. Any bookseller will order it for you.

A. H. L., of Mass.—There is no substance known which, placed between a magnet and its armature, will stop its attraction.

B. F. C., of R. I.—Your method of making leather handles is not new.

## Inventions Patented in England by Americans.

[Compiled rom the Commissioners of Patents' Journal.]

PROVISIONAL PROTECTION FOR SIX MONTHS.

2,905.—PNEUMATIC TELEGRAPH.—Edward A. Calahan, Brooklyn, and G. B. Baker, New York city. November 3, 1870.

2,924.—BUOYANT MATTRESS DESIGNED TO SERVE EITHER AS A BED OR A LIFE PRESERVER.—Joshua Hunt, Providence, R. I. November 5, 1870.

2,925.—AXLES OF RAILWAY AND TRAMWAY CARRIAGES, AND IN APPARATUS TO BE EMPLOYED THEREWITH.—Henry Graham Thompson, New York city November 5, 1870.

2,931.—TELL-TALE MECHANISM APPLICABLE TO CLOCKS AND WATCHES.—Cyrille Duquet, Quebec, Canada. November 21, 1870.

2,931.—MACHINE FOR CUTTING AND PRINTING LOZENGES AND CRACKERS.—Ernest Greenfield and Philipp Strauss, New York city. November 7, 1870.

2,935.—METALLIC COMPOSITION FOR ROOFING LININGS, PIPES, AND OTHER PURPOSES.—David J. Millard, Clayville, N. Y. November 7, 1870.

2,936.—IMPROVEMENT APPLICABLE TO TREADLES USED IN SEWING AND OTHER MACHINES.—Charles Gordon Patterson, New York city. November 7, 1870.

2,939.—MACHINERY FOR MANUFACTURING CARPET LINING.—Joel F. Fales, Walpole, Mass. November 9, 1870.

2,943.—PROCESS FOR EXTRACTING THE USEFUL SUBSTANCES OF HOPS, AND FOR MANUFACTURING A PURE AND CONCENTRATED EXTRACT OF HOPS.—C. A. Seely, New York city. November 8, 1870.

2,950.—METHOD OF SECURING OR LOCKING SCREW BOLTS AND NUTS.—Robinson Rutter, Vallejo, Cal. November 9, 1870.

2,953.—SEWING MACHINES AND TABLES FOR SEWING MACHINES.—J. N. Tarbox, Hamilton, Canada. November 9, 1870.

2,951.—APPARATUS FOR EFFECTING AND REGULATING THE SUPPLY OF THE DEODORIZING MATERIAL IN EARTH CLOSETS.—William R. C. Clark, Chicago, Ill., and James E. Aiken, New Orleans, La. November 9, 1870.

2,969.—MANUFACTURE OF ALKALIZED ISINGLASS, SULPHITED AND BISULPHITED.—Baylis Child, New York city. Nov. 11, 1870.

2,978 PENHOLDER AND PENS.—Isaac Jacobs, New York city. November 12, 1870.

## APPLICATIONS FOR EXTENSION OF PATENTS.

MACHINE FOR CUTTING PASTEBOARD FOR BOXES.—Franklin N. Clarke, New Haven, Conn., has petitioned for an extension of the above patent. Day of hearing Feb. 15, 1871.

ENEMA SYRINGE.—Herman E. Davidson, Gloucester, Mass., has petitioned for an extension of the above patent. Day of hearing March 15, 1871.

SEEDING MACHINE.—L. B. Myers and H. A. Myers, Elmore, Ohio., have petitioned for an extension of the above patent. Day of hearing Feb. 15, 1871.

CASTING SKEINS FOR WAGONS.—John Benedict, Kenosha, Wis., has petitioned for an extension of the above patent. Day of hearing Feb. 8, 1871.

ENEMA-GIVING APPARATUS.—Benjamin T. Babbitt, New York city, has petitioned for an extension of the above patent. Day of hearing March 1, 1871.

GAS GENERATORS.—Alonzo M. Giles, Boston, Mass., has petitioned for an extension of the above patent. Day of hearing March 1, 1871.

CHAIRS FOR INVALIDS.—James G. Holmes, Charleston, S. C., has petitioned for an extension of the above patent. Day of hearing May 31, 1871.

MACHINE FOR CUTTING AND BENDING SHEET METAL.—Elliot Savage, West Meriden, Conn., has petitioned for an extension of the above patent. Day of hearing March 1, 1871.

## Recent American and Foreign Patents.

*Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.*

COMPOSITION FOR DESTROYING WORMS IN THE COTTON PLANT.—Thoma W. Mitchell, Richmond, Texas.—The object of this invention is accomplished by sprinkling the cotton plants, on which the worm feeds, with a solution of arsenic in water, in suitable proportions.

"MIDDLINGS" PURIFIER.—Lemuel G. Binkly, Baughman, Ohio.—This invention relates to an arrangement of reels, one of which is covered with coarse cloth for separating and removing the coarse feed and shorts, the fine feed, middlings, and flour being thence conveyed to another reel covered with finer cloth. The middlings and fine feed are by this last separated from the flour, and conveyed to a chamber over the reels where a fan and hinged deflectors quickly separate them into three grades, and distributes them in hoppers or bins correspondingly.

PLOW.—Arthur C. Smith, Joyner's Depot, N. C.—This invention has for its object to improve the construction of turn-plows to better adapt them for running the first furrows in breaking up the land and forming the ridges in preparing the land for planting cotton.

SPICE BOXES.—Edward S. Kennedy, Birmingham (Buchanan Postoffice), Pa.—This invention has for its object to furnish an improved spice box, which shall be so constructed as to contain salt and pepper, or two other spices, and which shall, at the same time, be simple in construction and convenient in use.

FLOUR BOLTS.—Cyrus T. Hanna, Keokuk, Iowa.—This invention has for its object to furnish an improved flour bolt, which shall be so constructed that the bolt cloth may be secured to the inner sides of the ribs, forming a smooth surface of bolting cloth.

COTTON CULTIVATOR, SCRAPER, AND CHOPPER.—J. H. W. Young, Henderson, Texas.—This invention relates to certain improvements in a machine or cultivating cotton, the same consisting in barring-off plows placed in such position in front of the wheels, on which the machine runs, to make tracks in the earth for the wheels to follow in; also in shanks for the scrapers pivoted at their upper ends to the frame, and provided with curved slots through which pass bolts so as to enable the scraper sto be set at different angles, according to the nature of the soil through which they run; and in chopping hoes made adjustable for the purpose of varying their position according to the desired width of hill or ridge.

COTTON AND HAY PRESS.—S. K. Davis, Monticello, S. C.—This invention relates to improvements in the cotton and hay press patented September 28, 1869. The invention consists in providing two uprights with beveled joints and catches, which also act as supports, so as to permit a portion of the frame above the joints to be drawn from a perpendicular to an inclined position, and replaced at pleasure; also in constructing a nut with adjustable levers, and a groove for the reception of band or cord, by which the nut at each end of the press may be screwed down or up at the same time; also in the construction of a clamp provided with a hinge in such a manner that the clamp may be easily removed from the press when the bale has been formed.

SUBSOIL PLOW.—T. G. Wilder, Camden, Mo.—This invention has for its object to improve the construction of subsoil plows, so as to make them stronger, more substantial, and easier upon the team, and enables them to be conveniently adjusted to work deeper or shallower in the ground, as may be desired, and which will cause them when adjusted to work at a uniform depth.

PROPELLING APPARATUS FOR STREET CARS.—John Roy, New Orleans, La.—This invention relates to improvements in apparatus for propelling street cars by means of a traction rope worked along the track, either above or under the ground, by means of stationary engines or other power, and consists in the application to the car, either at one or both sides, or between the sides, of traction wheels, preferably three in a row, so arranged that the rope will work under the two end wheels, to be prevented from rising above the ground either in front or rear of the car and over the center wheel, so as to impart rotary motion to them, which, being arrested by brakes, will cause the car to be drawn along by the friction of the rope on the wheels.

BALANCED SLIDE VALVES.—John Nesbitt, Concord, N. H.—This invention relates to improvements in balanced slide valves, or those which are so arranged that they cannot be raised off their seats, when the throttle valve is closed and the piston continues in motion by the air, for admitting it behind the piston and preventing the forming of a vacuum, which greatly retards the motion, especially in the case of a locomotive going on a downward incline.

THUMB SUPPORTER.—James S. Borden, Bloomfield, Ill.—The object of this nvention is to provide convenient and efficient means for supporting and protecting the thumb of the hand in the operation of binding grain.

PORTABLE FARE BOX.—Alfred Bradley, New Orleans, La.—This invention has for its object to furnish an improved fare box for the conductor or collector to carry around when collecting fares, and which shall be so constructed that the fare cannot be extracted or removed by any one but the person having the key of the box.

MEDICAL COMPOUND.—N. Jenkins, New Orleans, La.—The object of this invention is to provide a simple, safe, and effectual remedy for rheumatism, gout, neuralgia, and kindred diseases.

SELF-ADJUSTING BARREL HANDLES.—Minot S. Schofield, Stamford, Conn.—This invention has for its object to furnish handles, which shall be so constructed as to adjust themselves to barrels, boxes, and other packages, to enable the said barrels, boxes, or packages to be conveniently handled.

BAG HOLDER.—A. D. Swogger, Worth, Pa.—This invention relates to a new bag holder, which is made vertically extensible, so that it can be used to fill bags of different lengths. The invention consists in making the frame of the holder extensible, and in providing pawls or catches for locking it at suitable lengths.

HORSE-COLLAR PADS.—Jas. F. Walsh, Hazel Green, Wis.—This invention relates to improvements in the construction of sweat pads for horse collars, and it consists of two broad pieces of leather, of the proper form to fit the breast and neck of the horse, with stiffening plates of iron stitched between them to keep them smooth, the inner piece being broader than the outer one, and the inner edge of it turned outward to prevent galling the neck, and held by short straps attached to the outer piece.

VINE AND WEED CUTTER.—Harry Lawrence, New York city.—This invention relates to improvements in apparatus for removing the vines of potatoes, weeds, and the like, in advance of the potato-digging machines, and it consists in a pair of forked gathering blades, a discharging trough, and a rotary cutter, mounted on a truck, or it may be on the potato-digging machine, for gathering, cutting, and discharging the vines and weeds.

POTATO DIGGER.—William Tripp, Mechanicsville, N. Y.—This invention relates to improvements in potato diggers, and consists of a peculiar construction of one-sided shovel-shaped, and plow-shaped diggers.

THREAD TAKE-UP.—Walter Bennett, Springfield, Ill.—This invention relates to improvements in thread take-up apparatus for sewing machines, and consists in improvements in the arrangement in that class of such apparatus, designed for varying the slack of the thread according to the thickness of the cloth.

NON-CONDUCTING COMPOSITION.—John Hessing, Paterson, N. J.—This invention relates to a new and improved non-heat conducting compound, suitable for covering marine, locomotive, stationary, and other steam boilers, cylinders, pipes, etc.

KNITTING MACHINE.—John Lee, Mark Lee, and William Carter, Needham, Mass.—This invention relates to improvements in knitting machines, and consists in a combination with a knitting machine, of a shifting receiver and holder and automatic operating devices therefor, for carrying yarns of different colors and changing them to be run in with the fabric, according to any required order or pattern. The invention also consists in certain improvements in the arrangements of the operating and adjusting devices of the knitting apparatus.

PRESS.—M. G. Cunningham, Corsecana, Texas. This invention relates to mprovements in presses for hay, cotton, and other like substances, and consists in an improved arrangement of means for working the follower by a screw.

SHIP'S WINDLASS.—Enos Waterbury and G. N. Waterbury, Stamford, Conn.—This invention has for its object to improve the construction of a ship's windlass in such a way as to make it more convenient in use, it being so constructed as to allow the cable to be payed out freely, and which shall, at the same time, be simple in construction and easily operated and controlled.

# Official List of Patents.

## ISSUED BY THE U. S. PATENT OFFICE.

FOR THE WEEK ENDING DEC. 27, 1870.

*Reported Officially for the Scientific American.*

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110,414.—APPARATUS FOR SUPPLYING AIR.—Henry W. Adams, Philadelphia, Pa.
110,415.—WOOD-SPLITTING MACHINE.—William A. Allen, Baltimore, Md.
110,416.—RAILROAD-CAR VENTILATOR.—George B. Armstrong, Chicago, Ill., and George F. McLellan, Washington, D. C.
110,417.—PLOW.—James Archer, Springfield, Wis.
110,418.—MACHINE FOR BURRING WOOL ON THE SKIN.—Edward H. Ashcroft, Lynn, Mass.
110,419.—CULTIVATOR.—Robert H. Avery, Galesburg, Ill.
110,420.—COFFEE-POT STRAINER.—George A. Barron, Pembroke, Me.
110,421.—BOTTLE FASTENING.—Benjamin Bates, Baltimore, Md.
110,422.—COUPLINGS FOR SHAFTING.—Charles Bean (assignor to Albert F. Allen), Providence, R. I.
110,423.—MEDICAL BITTERS.—Theodore Beck, Omaha, Nebraska.
110,424.—TAKE-UP MECHANISM FOR SEWING MACHINES.—Walter Bennett, Springfield, Ill.
110,425.—MIDDLINGS PURIFIER.—Lemuel G. Binkley, Baughman, Ohio.
110,426.—THUMB SUPPORTER.—James Sandford Borden, Bloomfield, Ill.
110,427.—METHOD OF PRODUCING ILLUMINATING GAS.—John F. Boynton, Syracuse, N. Y.
110,428.—PORTABLE FARE BOX.—Alfred Bradley (assignor to himself and W. L. Cushing), New Orleans, La.
110,429.—CHURN DASHER.—Robert Brown, Columbus, Miss.
110,430.—SAW TEETH.—Isaiah Byrd and Turner Byrd, Jr., Calvin Township, Mich. Antedated Dec. 9, 1870.
110,431.—WIRE FOR MAKING PEGS FOR BOOTS AND SHOES.—Duncan H. Campbell, Sunderland, Scotland, and Erastus Woodward, Charlestown, Mass.
110,432.—LUBRICATING COMPOUND FOR STEAM AND OTHER PACKING.—William M. Canfield, Philadelphia, Pa.
110,433.—BOOTJACK AND DOOR BUFFER.—Walter S. Chatham (assignor to John W. Riddell), Williamsport, Pa. Antedated Dec. 15, 1870.
110,434.—UMBRELLA HOLDER.—Almon Clarke (assignor of one half his right to Charles A. Spencer), Sheboygan Falls, Wis.
110,435.—ASTRONOMICAL LANTERN.—James Freeman Clarke West Roxbury, Mass.
110,436.—TIDAL MOTIVE POWER.—Walter R. Close, Bangor, Me.
110,437.—DIE PLATE FOR SCREW-CUTTING DIES.—William T Cole, New York city.
110,438.—FOLDING CHAIR.—Francis Colton, Brooklyn, N. Y.
110,439.—FASTENING FOR NECK TIES.—William J. Cowing, Washington, D. C.
110,440.—MACHINE FOR GROOVING BLOCKS FOR WOOD PAVEMENTS.—Perley D. Cummings, Portland, Me.
110,441.—SELF-CLEANING LOCOMOTIVE SMOKE STACK.—Samuel M. Cummins and Henry Israel (assignors for one third their right to Ransom C. Wright), Allegheny, Pa.
110,442.—PRESS FOR HAY, COTTON, ETC.—Matthew G. Cunningham, Corsicana, Texas.
110,443.—HAY AND COTTON PRESS.—Joseph K. Davis, Monticello, S. C.
110,444.—CARRIAGE WINDOW.—James F. Doley, Binghamton, N. Y. Antedated Dec. 15, 1870.
110,445.—GRAIN SEPARATOR.—James W. Donaldson, Fairfield, Cal.
110,446.—SNOW PLOW FOR RAILWAYS.—Tiberius Dougherty, Philadelphia, Pa.
110,447.—COMBINED BROADCAST SEEDER AND CULTIVATOR.—Joseph E. Fargo, Lake Mills, Wis. Antedated Dec. 10, 1870.
110,448.—DEVICE FOR SIGHTING AND FIRING ORDNANCE.—George K. Farrington, Alcatraz, Cal., assignor to himself Lorenzo Hubbard, and C. W. M. Smith.
110,449.—LENS OR GLASS FOR HEAD LIGHTS.—Henry C. Feltbousen, Buffalo, N. Y.
110,450.—BUSHING FOR WARP BEAMS.—Richard Ferguson, Louisville, Ky.
110,451.—SAW MILL.—Charles M. Flint, Hancock, N. H.
110,452.—DRIP ATTACHMENT FOR UMBRELLAS.—Thaddeus Fowler, Tottenville, N. Y.
110,453.—WASHING MACHINE.—Abram A. Gardner, Savannah, Mo.
110,454.—INCUBATOR.—Jacob Graves, Reading, and Henry Graves, Boston, Mass.
110,455.—POWER PRESS.—Albert D. Hamlin (assignor to Mays & Bliss), Brooklyn, N. Y. Antedated Dec. 22, 1870.
110,456.—FLOUR BOLT.—Cyrus T. Hanna, Keokuk, Iowa.
110,457.—LAWN MOWER.—Hubert C. Hart, Unionville, Conn.
110,458.—CORN PLANTER.—Charles Allen Haskell, Galena, Ill.
110,459.—CANAL LOCK MECHANISM.—George Heath Annapolis, Md.
110,460.—GAGE FOR TURNING CLOCK-WORK.—Harry F. Henderson and James E. Ladd, Bristol, Conn. Antedated December 24, 1870.
110,461.—NON-CONDUCTING COMPOUND FOR COATING STEAM BOILERS, ETC.—John Hessing, Paterson, N. Y.
110,462.—MACHINE FOR CUTTING THE ENDS OF HOOPS.—L. N. Hewes, Swansey, N. H.
110,463.—COMPOUND AND PROCESS OF REMOVING INCRUSTATIONS OF LIME FROM STEAM BOILERS, METALS, ETC.—J. Austin Hewett, Nora Springs, Iowa.
110,464.—LAMP.—Charles F. A. Hinrichs, New York city.
110,465.—MANUFACTURE OF LEATHER.—F. A. Holcomb, Grand Rapids, Mich., assignor to himself and S. B. Jenks.
110,466.—PROPULSION OF CANAL BOATS.—Julius L. Hornig, Chicago, Ill.
110,467.—FIRE-BOX FOR STOVES AND RANGES.—Marcus L. Horton, Windsor, Vt.
110,468.—DEVICE FOR FILLING LOWLANDS.—George Howell, Philadelphia, Pa. Antedated December 9, 1870.
110,469.—REFINING OIL FROM COTTON-WASTE, ETC.—Edgar T. Jarrold, Tottenville, assignor, by mesne assignments, to himself, Henry S. Gerow, and Henry McLean, New York city.
110,470.—MEDICAL COMPOUND FOR RHEUMATISM.—Nathaniel Jenkins, New Orleans, La.
110,471.—SPRING BED BOTTOM.—W. B. Judson, Poughkeepsie, N. Y., assignor to I. P. Nelson, Jr.
110,472.—BASE-BURNING STOVE.—William Kaiser, Wilkesbarre, Pa. Antedated December 17, 1870.
110,473.—SPICE BOX.—E. S. Kennedy, Birmingham (Buchanan Postoffice), Pa.
110,474.—SCYTHE FASTENING.—Samuel U. King, Windsor, Vt.
110,475.—SMUT MACHINE.—William H. Kite and George S. Newman, Liberty Mills, Va.
110,476.—ATTACHMENT FOR RATLINS.—John Calef Knowlton, Rockport, Mass.
110,477.—VINE AND WEED CUTTER.—Harry Lawrence, New York city.
110,478.—WASHING MACHINE.—Balaam C. Lawson, Yolo county, Cal.
110,479.—KNITTING MACHINE.—John Lee, Mark Lee, and William Carter, Needham, Mass.
110,480.—NEEDLES AND THEIR CARRYING ARMS FOR SEWING MACHINES.—George A. Lloyd, San Francisco, Cal., assignor to himself, G. W. Smiley, James McMeehan, and Anthony Roscnfeld.
110,481.—COMPOUND FOR CLEANING CARPETS.—Leo. Marks, Cincinnati, Ohio.
110,482.—WASHING MACHINE.—Moses S. Marshall, Somerville, assignor to John T. Folsom and J. S. Folsom, Boston, Mass.
110,483.—CONSTRUCTION OF PRISONS.—Edwin May, Indianapolis, Ind.
110,484.—WATER FAUCET.—Pierre A. Mayor, New York city.
110,485.—CAMP BEDSTEAD.—Amos D. McCoy, Alexandria, La. Antedated Dec. 16, 1870.
110,486.—AUTOMATIC DOOR BOLT.—Angus McKay, Montreal, Canada.
110,487.—CHURN DASHER.—James B. Mellor, New Hope, Mo.
110,488.—FILTER TANK AND OTHER VESSELS USED FOR REFINING SIRUPS, SUGAR, ETC.—William Moller, Irvington, N. Y.
110,489.—TREATING BESSEMER STEEL.—James Myers, Jr., Williamsburgh, N. Y.
110,490.—BALANCED SLIDE VALVE.—John Nesbitt, Concord, N. H.
110,491.—KEY FOR LOCKS.—Webster Park, Norwich, Conn. Antedated December 13, 1870.
110,492.—GRAIN BINDER.—La Fayette Parker, Davenport, Iowa.
110,493.—Suspended.
110,494.—COUNTERSINK.—Moses Magoon Pettes, Worcester, Mass.
110,495.—CLEANING WOOL, COTTON, ETC.—Goldsbury H. Pond, Rutland, Vt.
110,496.—GAS RETORT AND HEATING FURNACE.—Goldsbury H. Pond, Rutland, Vt.
110,497.—RAILWAY CAR SPRING.—Albert Potts, Philadelphia, Pa.
110,498.—GRAIN BINDER.—F. W. Randall, Tekonsha, Mich. Antedated December 17, 1870.
110,499.—LOCK NUT.—James L. Randolph, Berkeley Springs, West Va.; assignor to G. L. Denny, Christiana, Pa.
110,500.—NAIL FOR PICTURES, ETC.—Thomas C. Richards, New York city.
110,501.—PROPELLING APPARATUS FOR CARS.—John Roy, New Orleans, La.
110,502.—HANDLE FOR BARRELS, ETC.—Minot S. Schofield, Stamford, Conn.
110,503.—WHIP-HOLDER FOR CARRIAGES.—Erastus W. Scott, Wauregan, Conn.
110,504.—BOTTLE-FILLING APPARATUS.—Thomas Simmons and David H. Lowe, Brooklyn, N. Y. Antedated December 16, 1870.
110,505.—BREECH-LOADING FIRE-ARM.—James Smiles, Birmingham, England.
110,506.—PLOW.—A. C. Smith, Joyner's Depot, N. C.
110,507.—CABINET FOR SEWING MACHINES.—J. E. Smith (assignor to himself and Julius Ludwig), Chicago, Ill.
110,508.—EYELET MACHINE.—S. N. Smith (assignor to the Union Eyelet Company), Providence, R. I.
110,509.—BUCK SAW.—A. B. Sprout, Muncy, Pa.
110,510.—KEY FOR SHAFTING.—Nathan Stedman, Aurora, Ind.
110,511.—BAG HOLDER.—A. D. Swogger, Worth, Pa.
110,512.—TURN-UP SEAT FOR CHURCHES, ETC.—J. P. Tibbits, New York city.
110,513.—CARRIAGE BOW.—I. N. Topliff, Adrian, Mich.
110,514.—POTATO DIGGER.—William Tripp, Mechanicsville, N. Y.
110,515.—MACHINE FOR HEADING RIVET AND SCREW BLANKS.—V. De M. Upham, Brooklyn, N. Y. Antedated December 10 1870.
110,516.—STILL FOR PETROLEUM AND OTHER OILS.—S. Van Syckel, Titusville, Pa.
110,517.—(Suspended.)
110,518.—HORSE COLLAR PAD.—J. F. Walsh, Hazel Green Wis.
110,519.—TOY HOOP.—Rivera Ward, Newark, N. Y.
110,520.—ADDING MACHINE.—F. F. Warner, Chicago, Ill.
110,521.—WINDLASS.—Enos Waterbury and G. N. Waterbury (assignors to G. N. Waterbury and A. M. Prior), Stamford, Conn.
110,522.—PRINTERS' INKING ROLLER.—C. S. S. Westcott, Elizabeth, N. J., assignor to himself, John Austin, Bollin Germain, New York city, and W. H. H. Williams, Middletown, Conn. Antedated Dec. 17, 1870.
110,523.—ROLLER-LIFTING POWER.—Elisha Whitcomb Waterville, Ohio.
110,524.—LOOM.—Robert Whitehill (assignor to the Positive Motion Loom Company), New York city.
110,525.—SUBSOIL PLOW.—T. G. Wilder, Camden, Miss.
110,526.—LAMP.—T. S. Williams (assignor to himself and P S. Page), Boston, Mass.
110,527.—SEAT-GUARD FOR HOBBY HORSES.—W. L. Williams New York city. Antedated December 17, 1870.
110,528.—RUNNING GEAR FOR CARRIAGES.—J. B. Withey Detroit, Mich.
110,529.—MACHINE FOR MAKING BRUSHES.—O. D. Woodbury, New York city.
110,530.—BORING MACHINE.—E. J. Worcester, Worcester, Mass.
110,531.—COTTON CULTIVATOR, SCRAPER, AND CHOPPER.—J. H. W. Young, Henderson, Texas.
110,532.—WOOD-SCREW MACHINE.—J. M. Alden (assignor to the International Screw-nail Company), New York city.
110,533.—TREADLE.—A. M. Allen, New York city.
110,534.—COPE FOR CASTING CAR WHEELS.—Albert Alling, Chicago, Ill.
110,535.—THREAD GUIDE AND HOLDER FOR BOBBIN-WINDING MACHINE.—W. W. Altemus, Philadelphia, Pa.
110,536.—PAPER-BAG MACHINE.—C. F. Annan, Boston, assignor to himself and H. S. Merrill, Cambridge, Mass.
110,537.—ADJUSTABLE CAM.—C. F. Annan, Boston, assignor to himself and H. S. Merrill, Boston, Mass.
110,538.—PORTABLE STORE ROOM AND PANTRY.—T. A. Barrell, Marcs, Ill.
110,539.—COTTON-BALE TIE.—G. N. Beard, St. Louis, Mo.
110,540.—MACHINE FOR DRYING PAPER AND OTHER FABRICS.—Frederick Beck, New York city.
110,541.—HORSE YOKE.—A. B. Beaumont, Austerlitz, Mich.
110,542.—GRAIN THRASHER, SEPARATOR, AND CLEANER.—E M. Birdsall, Penn Yan, N. Y.
110,543.—SIFTER.—S. O. Blanding, Vineland, N. J.
110,544.—WATER WHEEL.—J. W. Bookwalter, Springfield Ohio.
110,545.—COMBINED IMMERSION AND STEAM BATH.—J. W Caldwell, Cincinnati, Ohio.
110,546.—BRIDGE.—A. McD. Campbell, Newark, N. J., assignor to himself, C. M. Bolen, and F. K. Day.
110,547.—ANNUNCIATOR.—Jacob Capron, New York city.
110,548.—CULTIVATOR.—J. H. Carlow, Kidder, Mo.
110,549.—COTTON PRESS.—Nash Cheek, Chapel Hill, N. C.
110,550.—PLOW.—Josiah Clifton, Georgetown, Texas.
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REISSUES.

4,215.—HOISTING BLOCK.—Joseph A. Burr, Brooklyn, assignor to Burr & Co., New York city.—Patent No. 108,446, dated October 18, 1870.

4,216.—SHOVEL PLOW AND POTATO-DIGGER COMBINED.—James Millen Dick (assignor to himself and William H. Albro), Buffalo, N. Y.—Patent No. 105,922, dated August 2, 1870.
4,217.—DIVISION B.—HARVESTER.—Rufus Dutton, Yonkers, N. Y.—Patent No. 31,878, dated February 12, 1861; reissue No. 4,125, dated September 20, 1870.
4,218.—BROILER.—James T. Page, Rochester, N. Y.—Patent No. 106,280, dated August 9, 1870.
4,219.—RESERVOIR COOKING STOVES.—George H. Phillips, Troy, N. Y.—Patent No. 86,585, dated February 2, 1869.
4,220.—WATER-PIPE MACHINE.—John W. Stockwell, Portland, Maine.—Patent No. 106,434, dated August 16, 1870.
4,221.—LAMP CHIMNEY.—The Requa Patent Concave Burner and Chimney Company, New York city, assignee of E. B. Requa.—Patent No. 37,772, dated February 24, 1863.
4,222.—GANG PLOW.—George W. Hildreth, Lockport, N. Y.—Patent No. 14,297, dated October 14, 1857.

DESIGNS.

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EXTENSIONS.

MACHINE FOR GRINDING SAWS.—Emanuel Andrews, of Williamsport, Pa.—Letters Patent, No. 16,223, dated December 16, 1856; reissue No. 2,200, dated June 19, 1866.
PAPER-PULP ENGINE.—Joseph Kingsland, Jr., of Franklin, N. J.—Letters Patent No. 16,278, dated December 23, 1856.
MACHINE FOR GRINDING PAPER PULP.—Joseph Kingsland, Jr., of Franklin, N. J.—Letters Patent No. 16,299, dated December 16, 1856; reissue No. 745, dated June 28, 1859; reissue No. 1,280, dated January 6, 1863.
PROCESS OF GRINDING PAPER PULP.—Joseph Kingsland, Jr., of Franklin, N. J.—Letters Patent No. 16,316, dated December 23, 1856; reissue No. 744, dated June 28, 1859; reissue No. 1,301, dated January 6, 1863.


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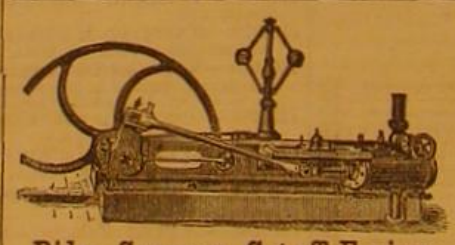

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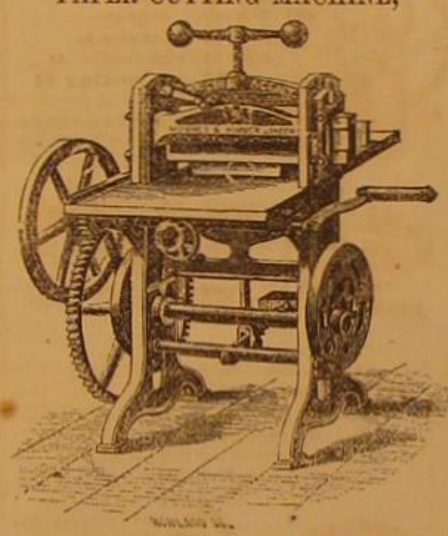

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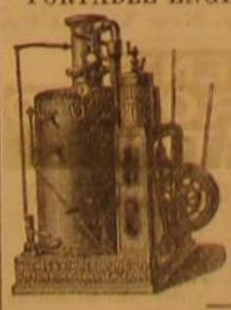

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# SCIENTIFIC AMERICAN

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### Improved Cotton Press.

Our engraving represents a cotton press constructed upon a new principle, for which are claimed several advantages over presses hitherto constructed. The nature of the advantages claimed will better appear after a glance at the details and operation of the press.

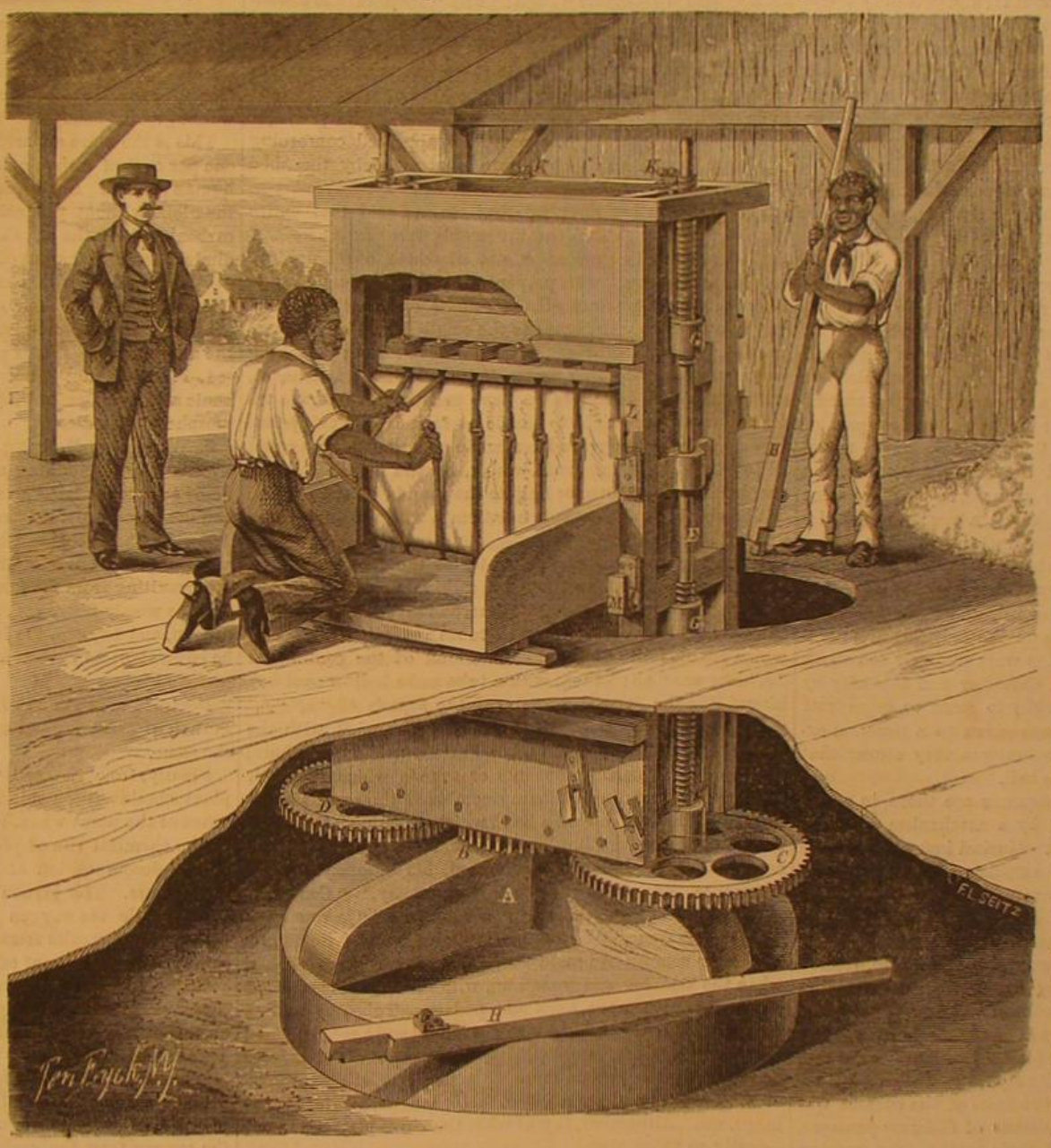
A, in the engraving, Fig. 1, is a pedestal having a central pivot, upon which the entire superstructure turns during the compression of the bales. Fixed firmly to the pedestal is the toothed wheel, B, which gears into both the toothed wheels, C and D. The latter wheels are keyed to upright screw shafts, E and F, each shaft having two screw threads—one a right-hand thread and one a left hand thread.

These screws run in nuts, G, attached to the followers, of which there are two, one above and one below the bale. The upper follower descends and the lower one ascends simultaneously, leaving the bale, when pressed, in the position shown in Fig. 1.

The screws are worked by inserting the levers, H, into the space between angular lugs, I, and the side wall of the press, and by their aid turning the entire press, with its contents, about the central pivot. The toothed wheel, B, being fixed, the turning of the press causes the wheels, C and D, to turn with their screw shafts, and run down the upper follower and run up the lower one, to compress the cotton. Reversing the motion runs these followers back to their first position—the position of the upper one when run up being shown in Fig. 2. Angular metal straps, J, Fig. 2, then receive the ends of the levers, H, which are then hinged at K, the counterpart of the hinges being upon the levers themselves. The depression of the outer ends of the levers opens the follower like a lid on its hinges, and *vice versa*.

The bale, when pressed, is taken out of a door in the side of the press, as shown in Fig. 1. The door, when closed, is held together by a strong bar, engaging with lugs, L, and another strong bar pivotedor hinged at M.

The advantages claimed for this press are, that the use of two screws always keeps the bale of uniform size at both ends, that the double screws and arrangement of gearing give great strength to the press, and rapidity in pressing, that the press can be afforded at a cheap rate, that it possesses no complications liable to get out of repair, and that it is adapted to be driven by horse or steam power if desired, through the addition of suitable appliances.




BOOTON'S COTTON PRESS

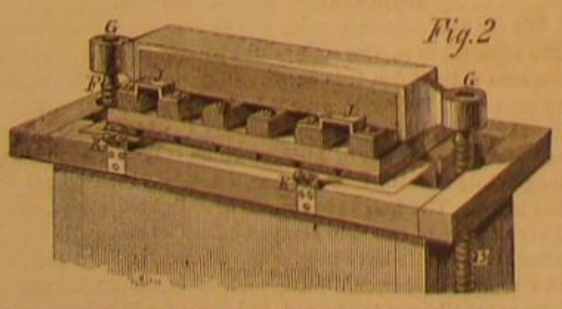



Fig. 2

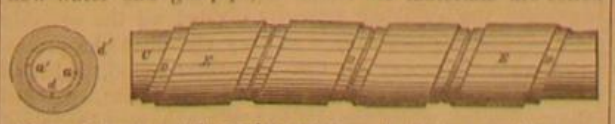
Patented, through the Scientific American Patent Agency, Oct. 18, 1870, by Sinclair Booton, whom address for further information, care T. D. Johnston, San Antonio, Texas.

### Boring Machines at the Mont Cenis Tunnel.

Prof. Ansted says that it is a curious and instructive sight to see a workman connect an elastic tube of about half an inch diameter with one of these machines, and watch the result when a small tap is turned. A piston-rod, working in an exceedingly small and short cylinder, immediately files backwards and forwards with wonderful rapidity, regulated by a small but rather heavy fly-wheel. Immediately a ponderous chisel, 6 or 7 feet long and more than an inch in diameter, is set in motion, and, having been previously placed in position, strikes a succession of heavy blows against the stone. Fragments begin to fly in all directions. Each time that the chisel strikes it is withdrawn a little way, very slightly turned, and immediately strikes again in the same hole. The stone experimented upon being of the hardest and toughest kind, the effect is not seen for several strokes; but within two minutes, during which the writer watched the experiment, a steel chisel was completely blunted and rendered useless, and there was a hole made about two inches deep in the mass of quartzite placed to operate upon. It is evident that nothing can resist such an attack; and, indeed, holes are bored in this way in an hour that would formerly have taken a day. The machines occupy very little space, and are by no means cumbrous. They can very easily be moved when and where they are needed. As many as seventeen are at work together in the end of the tunnel where the advance is being made. As the power is compressed air, they not only add no heat to the interior, but render it cooler by the absorption of heat during expansion. The air, when it escapes, is available for ventilation. It would be quite impossible to carry steam at a high pressure through pipes four miles long, but little diminution of force is experienced in working with the air, although all the engines and condensers, as well as the cylinders for storing the air, are outside the mouth of the tunnel. The length of pipe at present on the Piedmont side is about four and one fourth miles. The pressure of air commonly employed is about six and a half atmospheres, or nearly 100 lbs. on the square inch.

### STOW'S NON-CORRODING WATER AND GAS PIPE.

Our engraving, which accompanies this article, illustrates a new water and gas pipe, in which the materials are coiled



strips of sheet metal or wire, paper, and pitch, or coal-tar varnish. The pipes thus made, specimens of which have been submitted to us, seem strong, and they are not only much lighter than metal pipes designed to sustain the same pressure, but are totally free from objection in a sanitary point of view.

The pipes are made by coiling around a mandrel, C, a strip of pitched paper, D. Outside of the paper coil is then wound the sheet metal or wire coil, E, which is cemented to pitched-paper coil. If wire is used pitched paper is interposed between the layers.

The partially formed pipe is then covered with single or double roofing pitched paper, and the inside thoroughly coated with hot pitch or coal-tar varnish, which fills all the interstices and gives a smooth interior surface, preventing any contact of water with the metal, and consequent oxidation.

It is claimed that the compound material of which the pipe is mainly composed, being a very slow conductor, the water in the pipe is protected from the effects of frost. For very cold climates or exposed situations the thickness of the outer coating of paper and pitch may be increased to any desired degree, to render the protection from frost perfect; or a coating of pitch and sawdust may be added to increase the thickness. We are informed that it has been proved by experiment, that a pipe of this kind, of three fourths inch caliber, and five sixteenths of an inch thick, will withstand a pressure of five hundred pounds to the square inch. The strength of the pipe may be increased indefinitely by applying more spiral strips of metal, interposing pitched paper between them.

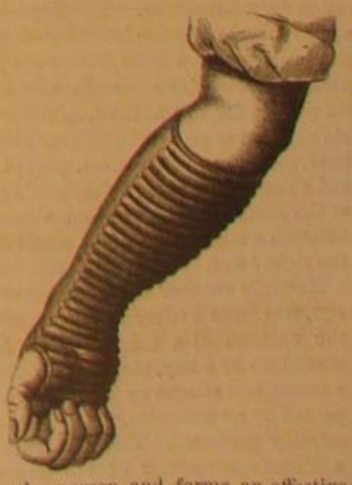
It is further claimed that these pipes are cheaper, stronger, and more durable, than metal pipes, and that they are not affected by acids generally found in water.

For gas mains the pipes are coated on the inside with an acid proof composition. The pipes can be made of any required size, for gas or water mains.

For right to manufacture, address the patentee, Henry M. Stow, New York city.

### WASHING SHIELD.

In the rubbing of clothes by the hands, the skin is liable to be abraded from the mechanical action, which is greatl aided by the softening of the skin from the effect of the free alkali in the soap employed. To protect the hands from this abrasion the device shown in our engraving has been invented. It was patented by C. F. Lewis, of Washington, D. C., February 5, 1867.



The device consists in a corrugated shield or armor, which protects the person and forms an effective surface for rubbing the clothes.

THE Chesapeake Bay oysters, which last February were transferred to the Pacific coast, and planted in the Bay of San Francisco, have increased to a wonderful size, and, as the journals of San Francisco assert, are much superior in flavor, grow more rapidly, and thrive better than the oysters in the beds on the Atlantic coast.

## TALKING MACHINES.

[Condensed from All the Year Round.]

A distinction between the honest and the deceptive in such contrivances deserves to be noted. There have been some so-called talking and singing machines, in which the talking and singing really came from human lips, under such circumstances as led the audience to believe that mechanism produced the sounds. We know very little about Roger Bacon's speaking head; but there is reason to believe that, if the machine were ever produced at all, the sounds emitted came from human lips. A famous exhibition, called the "Invisible Girl," was a deception in which much ingenuity was displayed. In this machine there was a girl or lady concerned, who did the talking and singing, and who was invisible to the audience; the deception consisted in leading the visitors to suppose that she was in a small globe suspended in mid-air. There were four upright posts, united at top by four horizontal rails, like the framework of a table. Bent wires, springing up from the posts, converged to an ornamental center; and from these wires were suspended a hollow copper ball, with four trumpet mouths on four sides. This was all the visitors saw. Any person wishing to propose a question, spoke it into one of the trumpet mouths; and presently afterwards an appropriate answer came from all the four mouths. The voice was so soft that it seemed to come from a very young and diminutive being indeed—a fairy, an invisible girl. French and Italian were spoken by the voice as well as English; witty and lively remarks were made, as well as questions answered; and songs were beautifully sung in silvery tones. It was admitted on all hands to be an attractive exhibition; and as there were means of verifying the fact that the globe touched nothing whatever, except four ribbons by which it was suspended, the surprise felt was great.

The facts of the case were these. One of the posts was hollow, as were two of the rails; and there were openings in the rails just opposite two of the trumpet mouths. In an adjoining room was a lady seated at a pianoforte; a very small opening in the partition between the two rooms enabled her to see what was going on; while a concealed tube was carried from a point near the level of her ear to the hollow part of the machine, beneath the floor. Sounds, as we know, travel very easily through tubes; and thus the questioning, the answering, the singing, and the pianoforte playing, were transferred from room to room. When a spectator asked a question speaking at one of the trumpet mouths, the sound was reflected from the trumpet back to the opening in the horizontal rail, which opening was neither seen nor suspected by the audience; it went down the rail, under the floor, and into the adjoining apartment, where the lady heard it; and the sounds in the opposite direction were similarly conveyed. The sound became so altered in character and intensity by this process of transmission as really to seem to come from the ball; and when an answer was given to a question expressed in a whisper, the impression was very strong that the answers really came from the ball.

But the more interesting contrivances are those in which the sounds are really produced by a mechanism of pipes, bellows, keys, vibrating reed, etc. Musical instruments have in some cases been played with surprising success by such means, involving the expenditure of an almost incredible amount of time, patience, and ingenuity in devising the requisite arrangements. Vaucanson's flute player was a wonderful example of this kind. It was a life-size figure, dressed in the ordinary fashion of his day (about 1730), and standing on a pedestal; both figure and pedestal being full of delicate machinery, essential to the working of the machine. When wound up with a key, the figure played real music on a real flute. Air was projected from the mouth to the embouchure or mouth-hole of the flute; and the force of the current was varied to suit the loudness or softness of different passages, as well as the different pitch of their octaves, the opening between the lips being varied to assist in producing the desired effects. The fingers, made of some elastic material, stopped the holes in the proper order for producing the several notes. The machine was constructed to play a certain number of tunes, beyond which its powers did not extend. Soon afterwards the same clever mechanician produced his automaton flageolet-player. The flageolet had only three holes; and so diverse was the intensity of wind required to produce all the notes of a tune with such limited means, that the pressure varied from one ounce for the lowest note up to fifty-six pounds for the highest. Another of his productions was his automaton pipe and tambour player; the figure of a shepherd, standing on a pedestal, played nearly twenty minuets and country dances on a shepherd's pipe held in the left hand, at the same time playing on a tambour (a kind of hybrid between a tambourine and a small drum) with a stick held in the right hand.

Maelzel's automaton trumpeter, exhibited about sixty years ago, was quite a triumph of ingenuity. A figure, dressed in the uniform of a trumpeter of Austrian dragoons, when wound up by a key, played the Austrian Cavalry March, and a march and allegro by Weigl, on a trumpet, and was accompanied by an orchestra, the sounds of the trumpet being admirably produced. Then, his dress being changed to that of a French trumpeter of the Guard, the figure played the French Cavalry March, all the signals, a march by Dussek, and an allegro by Pleyel. When we consider the numerous modifications of pressure with which the lips of a trumpeter touch the small end of the trumpet, the production of such results by machinery is certainly surprising. Soon after Maelzel's time, Maillardet produced an automaton pianoforte player. The figure of a lady, seated at a pianoforte, played no less than eighteen tunes, keeping on for an hour when once wound up; the machinery was laid open at intervals in such a way as to show that it was really mechanism that played. The white keys or natural notes were pressed with the fingers in the usual way, but the flats and sharps were produced by pressing on pedals with the feet. The inventor succeeded in making this lady more graceful in her attitude and movements than is generally the case with automata. Somewhere about 1820 there was an exhibition of two automaton flute-players in London; the two figures played eighteen duets, which must have required a vast amount of interior mechanism.

Another class of these ingenious contrivances comprises pieces of mechanism, which imitate the cry of certain animals and the song of birds. This has been rather a favorite problem with clockmakers, and there are many famous clocks of this kind.

The machines which, with more or less success, imitate human speech, are the most difficult to construct, so many are the agencies engaged in uttering even a single word—lungs, larynx, tongue, palate, teeth, lips—so many are the inflections and variations of tone and articulation, that the mechanician finds his ingenuity taxed to the uttermost to imitate them. The speaking doll, which gives forth its melancholy and woe-begone "Papa!" and "Mamma!" is a wonderment to all the little folks, who regret very earnestly that such dolls are too expensive to be freely purchased; but it is, nevertheless, a poor affair, albeit there has been much care and thought bestowed in devising the kind of vibrating reed to be used.

About ninety years ago, a pamphlet appeared concerning two large brazen heads that were constructed by the Abbé Mical, to effect something in the talking way. What was really done is rather doubtful; but we are told that entire phrases were pronounced, that the sounds were "*sur-humaine*," that there were two cylinders, one of which could produce determinate phrases, with proper intervals and prosody, while the other could produce all the sounds of the French language, analyzed and reduced to the smallest number. There were people uncharitable enough to believe that the speaking was managed by a living person in an adjoining apartment, as in some other instances we have mentioned; but the information was too slight to enable us to judge on this point. Kratzenstein, a few years later, made experiments on a series of tubes and vibrating reeds, which, by the aid of bellows, enabled him to produce or imitate the sounds of the vowels; but he appears to have made no attempt with the much more difficult sounds of consonants.

Wolfgang von Kempelen, inventor of the far-famed automaton chess player, constructed a talking figure which cost him a large amount of thought, time, and inventive ingenuity. First, he made experiments with tubes and vibrating reeds, which enabled him to imitate the sound of the continental 'a," like our "ah;" then, with a tube and a hollow oval box hinged like the jaws, he produced the sounds of "a," "o," "ou," and an imperfect "e;" then he succeeded with the consonants "p," "m," and "l," and afterwards a few others; but there were some consonants or sounds which he never succeeded in imitating. Having combined the results of his researches, he constructed a head which contained the requisite wind tubes and vibrating reeds, and a bust provided with some kind of bellows. Thus armed, his automaton could pronounce the words "opera," "astronomy," "Constantinople," "vous êtes mon amie," "je vous amie," "je vous aime de tout mon cœur," "Leopoldus secundus," and "Romanum imperator semper Augustus." These words were spoken when the machine was wound up, without any player being required to press upon keys and pedals. Tubes to imitate nostrils produced "m" and "n;" a funnel and a reed changed "s" into "z," "sch," and "j;" and there were various pieces of mechanism to imitate more or less successfully the movements and action of mouth, lips, teeth, tongue, palate, glottis, lungs, etc. Altogether, it was what the chess-player was not—really an automaton.

Professor Willis and Sir Charles Wheatstone some years ago devoted a good deal of attention to this matter; not, of course, for any exhibition purposes, but to analyze the production of vocal sounds in a scientific way. Sir Charles showed the results of his experiments at one of the meetings of the British Association. Professor Willis separated all the sounds, whether letters or exclamations, emitted in speaking, into three groups, which he called mutes, sonants and narisonants. Leaving consonants untried, he made experiments in the mode of producing vowel sounds by mechanism. With an air chest, vibrating reeds, and cavities and tubes of different kinds, he produced a great variety of sounds. One curious result of his experiments was, that with the same apparatus, drawn out gradually in length, he could produce in succession all the vowel sounds which are heard in such English words as "see," "pet," "pay," "past," "pan," "caught," "no," "but," "book," "boot;" we find, in effect, that the lips protrude more and more as this series advances; and this supplies a noteworthy confirmation of the views held on this matter by the experimenter.

Some of the readers of this article may perhaps remember Professor Faber's automaton-speaking figure, called the "Euphonia," when exhibited in London. It was a draped bust with a wax face. Concealed from the visitors were sixteen keys or levers, a small pair of bellows, and numerous little bits of metal, wood and india-rubber. When any word or sentence was spoken out, either by Faber or by one of the audience, the exhibitor mentally divided all the syllables into as many distinct sounds as they embodied; he pressed upon a particular key for each particular sound, which admitted a blast of air to a particular compartment, in which the mechanism was of the kind to produce the sound required; there were thus as many pressures as there were elementary sounds. By a modification of the movements, whispering could be produced instead of speaking.

This machine has been improved by the nephew of Herr Faber, and has recently been exhibited in London. One good point about it is that every part of the mechanism is laid fairly open to visitors. True, a wax head or mask is used, through the lips of which the produced sounds are really emitted; but this mask is at intervals removed, to show the movements of india-rubber lips and tongue belonging to the machine itself. The elementary sounds, by further analysis, have been brought down to fourteen, all others having been found to be really compound sounds, made up of two or more elements. A lady, seated at a kind of key-board, has fourteen keys or short levers before her; a sentence is given out, in any one of two or three languages; the lady instantly analyzes the sounds, and decides which of the keys will produce each, or which combination will produce the whole of them; she then plays, somewhat in the manner of harmonia-playing, giving the proper number of pressures on the properly selected keys. Some sounds are difficult to imitate, some are imitated readily; a laugh is capitally given, and a cry is sufficiently doleful for all required purposes; a whisper and a sigh are also producible.

### What Becomes of Carbonic Acid?

Animal life, and fire, diminish the amount of oxygen in the atmosphere, while increasing the amount of carbonic acid. Hence, in the lapse of time, the present conditions for life would greatly change.

This is the more apparent, since air containing as much as one per cent of carbonic acid acts already deleterious on the human system. But as animal life has existed for ages on the globe without producing any dangerous accumulation of carbonic acid in the air, there must exist a cause continually diminishing the amount of this gas in the air.

Vegetable life is this cause. Plants absorb carbonic acid from the air, build their substance mainly from the carbon contained therein, and give up a great part of the oxygen to the atmosphere. This is proved by the following facts:

1. Plants cannot grow in air completely deprived of carbonic acid, for, brought into such an artificially prepared atmosphere, they die.

2. When a small, living branch with leaves is brought into a glass vessel containing atmospheric air, the amount of carbonic acid in the latter diminishes, while the amount of oxygen increases, provided the plant be exposed to the sunlight.

Besides the carbonic acid, plants take also water from the air, and part of the latter is found to combine with the carbon resulting from the former. The principal parts of plants, such as woody fiber, etc., is indeed composed of carbon, hydrogen, and oxygen, the latter two in such proportions as to be equivalent to carbon and water. Hence they are termed *carbohydrates*.

Decaying animal matter exerts a favorable influence on the growth of plants, constituting a ready source of nitrogen to the same.

Finally, from the soil wherein the plant has its root, the plant obtains those mineral matters which constitute the ashes of the plant when burnt.

The chemical life of plants thus appears to consist mainly in the decomposition of the carbonic acid taken from the atmosphere. The carbon is accumulated in the body of the plant, while the oxygen is returned to the air. But since carbonic acid results from carbon and oxygen under production of a great amount of heat, heat must be applied to it to separate the carbon from the oxygen. The life of plants, therefore requires the expenditure of a great amount of heat or power to reduce the compound to carbon and free oxygen. This expenditure of heat is met by the sun's rays Hence it is that plants grow only in the sunshine.

Since animals cannot live without plants and since the plants require the power of the sunbeam in order to separate the oxygen from the carbon, we see that the sunbeam is the true source of all physical life upon the earth.

Since, finally, the muscular power and the heat of animals are due to the combustion of carbon and oxygen, both furnished them by the sun's action on the plant, the life of animals, both in regard to heat and power, is a direct effect of the sunbeam, being neither more nor less in amount, only changed in form.—*Am. Scientific Monthly.*

### Hampshire, Eng., Bacon.

We cut the following from one of our foreign exchanges: The reputation of the Hampshire bacon is owing entirely to the care with which it is cured. The hogs, which are fatted on peas and barley meal, are kept fasting for twenty-four hours at least before they are killed; they are used as gently as possible in the act of killing, which is done by inserting a long-pointed knife into the main artery which comes from the heart. The hair is burnt off with lighted straw, and the dirty surface of the skin scraped off. The carcass is hung up after the entrails have been removed, and the next day, when the meat has become quite cold, it is cut up into flitches. The spare-ribs are taken out, and the bloody veins carefully removed; the whole is then covered with salt, with a small quantity of saltpeter mixed with it. Sometimes a little brown sugar is added, which gives a pleasant sweetness to the bacon. The flitches are laid on a low wooden table, which has a small raised border at the lower end. The table slants a little, so as to let the brine run off into a vessel placed under it, by a small opening in the border at the lower end.

The flitches are turned up and salted every day; those which were uppermost are put under, and in three weeks they are ready to be hung up to dry. Smoking the bacon is no longer as common as it used to be, as simply drying in

the salt is found sufficient to make it keep. Those who from early association like the flavor given by the smoke of wood, burn sawdust and shavings in a smothered fire for some time under the flitches.

When they are quite dry they are placed on a board-rack for the use of the family or are packed with wheat chaff into chests till they are sold. The practice of cutting the hogs into pieces and pickling them in a vat, being attended with less trouble, is very generally preferred when there is only a sufficient number of hogs killed to serve the farmer's family; but flitches of bacon well cured are more profitable for sale. Corn-fed bacon is at least equal if not superior to the barley-fed, which is considered the prime article in England.

### Consumption of Alcoholic Drinks by the Wealthier Classes.

We may appeal to any medical man with a knowledge either of metropolitan or of provincial society as to the accuracy of the following computation. We shall admit, in the first place, that there are many men and very many women who drink almost no alcohol. But the greater number of men, and a large number of women, of the middle and upper ranks, habitually take a daily allowance of alcohol far larger than that above indicated. We purposely leave out of sight the reckless "fast" men who are perpetually "nipping" at bitters or absinthe, or "setting themselves right" with just another "brandy and soda;" and also the miserable women—whose numbers none but the doctors even faintly suspect—who indulge in secret dram-drinking. Excluding all such persons from our reckoning, let us merely consider the case of the moderate diners-out and the virtuous dancing young ladies. The former will certainly take on the average eight ounces of strong wines, and twelve to sixteen of light wines, daily; or he will make up the equivalent of this with beer or with spirits; in fact, he will take about three ounces of absolute alcohol, or the equivalent of about a gallon of the puddle-beer that laborers drink. And the young lady will not take less than three fourths of this quantity by the time she has finished her last champagne-cup at the ball or rout. If any one thinks this estimate excessive, we assure him that, were it discreet, we could produce accurate notes of the performances of sundry terpsichorean and otherwise athletic young ladies, of irreproachable character, to which the foregoing facts are a trifle.

It is, in fact, a considerable puzzle to understand, at first, how our respectable classes manage to consume so much more alcohol, without reproach, than the unfortunate Wiltshire clodhopper, for example, can do. No doubt one reason is that their drinks are not muddled with *Cocculus indicus*, etc., as his is. But no doubt the truth is that the intoxicative, that is the *visibly* poisonous effects of alcohol, are mainly kept at bay by powerful exertion either of the muscular or nervous system; and the wealthy classes to a large extent do task either one or both of these systems far more heavily than laborers, except those employed in some specially fatiguing callings. Nevertheless there is grave danger of excess, were it merely from the multiplication of alcoholic drinks which are taken by the richer classes.—*Dr. Anstie's "Uses of Wine in Health and Disease."*

### A Dangerous Water Pipe.

The following remarks of the Boston *Journal of Chemistry* are worthy of careful study:

"Attention has been called several times in the *Journal* to the dangerous character of galvanized iron pipe, when employed for conducting water to be used for culinary purposes. Instances of severe poisoning from the use of this pipe are continually coming to our notice, and we are led once more to caution our readers against it. It is almost a crime for dealers and manufacturers to recommend this zinc-covered iron pipe for water conduit, as they thereby jeopardize the health and perhaps the lives of purchasers. When this comes from the hands of the manufacturers it has a fresh, clean appearance, and to those who do not understand the nature of the covering the idea is conveyed that it will not oxidize or rust like iron pipes. But this is an error; it will even rust more rapidly than clean iron in most localities. The superficial covering of zinc is rapidly decomposed under the influence of ordinary pond and spring waters, and the oxide, carbonate, and chloride of zinc are formed, which salts are of a deleterious or poisonous character. This covering of zinc on the interior is attacked immediately when water is allowed to flow through, and in some instances we have known it to be entirely removed in forty-eight hours. The insoluble carbonate of zinc is seen to float upon the water in a tea-kettle or other water vessel used in families, and this has often created alarm where no suspicions previously existed."

[The SCIENTIFIC AMERICAN has already called attention to the fact that galvanized iron pipes could only be used with safety for domestic purposes in cases where chemical analysis proved the water to contain nothing capable of combining to form soluble compounds with the oxide of zinc, or capable of dissolving this oxide.—EDS.

### Count Moltke, aged 70.

The most potential man in the world just now, says the London *Lancet*, is General Moltke, and the days of his years are threescore years and ten. We will leave military critics to do justice to the military genius of Moltke, and to say where he is to be placed in comparison with Grant, and Wellington, and Napoleon, and Marlborough, and the older heroes of the world. What we design now is much more simple, but equally interesting. The "still strong man," about whom one hears so little, who can be "interviewed" only by Bismark and by the Royal family of Prussia, and without whom all Bismark's grand designs might have been unavailing, the man who is renewing the art of war, and concentrating with such terrible efficiency the whole force and manhood and discipline of Germany, is seventy years old. The King of Prussia, himself seventy-three, has made him a count in honor of his seventieth birthday; but to us it is far more interesting to know that he has reached that age, than to hear that he has become Count Moltke. Grant is not yet fifty years old. Marlborough was all done with war by the time he was about sixty. Napoleon died at the age of fifty-two. Wellington's military career was over before the age at which Moltke began to distinguish himself. Indeed, before the war with Austria, Moltke had kept his power and his genius very much to himself.

Here, then, is a point for physiologists, that a man of seventy may alter the complexion of the world, and the relation of nations, and the history of civilization; that he may at this age have physical power for going through arduous bodily exertion, and mental power for solving the most tremendous military problems. Meantime, let the example of Moltke cheer old men, and make many young men more modest.

### Agricultural Items from Various Sources.

PROFITABLE CULTURE.—In March, 1869, Mr. C. A. Hutchinson, of Jacksonville, Florida, planted a plot 50 feet square, with orange seed. In February next the plants were 12 to 18 inches high, when $200 worth were sold at the rate of $20 per hundred. The remainder were transplanted, and are now 2½ to 3 feet high, and occupy a space of 50 by 100 feet, and number about 8,000 plants. They are worth an average of $30 per hundred in the market, making the product of the lot, within two years, $2,600. The expense of seed and cultivation is estimated at about $60.

BANANA CULTURE.—The cultivation of the banana is engaging considerable attention in the neighborhood of Palatka, Florida, and the river counties. Three years ago a gentleman in Orange county set out nine plants, and is now reaping the fruits of a three-acre field, and realizes $125 per month from the fruit and the young plants that are continually suckering around the roots of the old plants. The banana fruits in all seasons, the year round, and is fertilized by the shedding of its huge leaves.

CRANBERRIES.—It is stated that quite an impetus has been given to the sale of marsh lands in Washington Territory recently, by the advent of a New Jersey cranberry grower in quest of these valuable lands. The Oregon *Statesman* says there is a large marsh near Gray's Harbor, in that State, which is already covered with cranberry bushes growing wild, and yielding considerable fruit, which is picked and sold by the Indians. This marsh has been purchased of the Government by several gentlemen of Salem, N. J.

CALIFORNIA WINES.—It is estimated that 700,000 to 800,000 gallons of red and white wine have been made in Anaheim, Los Angeles county, Cal., for this season, and of a better quality than the product of any preceding year. The amount is 250,000 gallons in excess of the yield of any previous season. It is claimed that, owing to the fine weather and the extra condition of the grapes, this wine is already so thoroughly fermented that it will be in a marketable conditon in sixty days. Preparations are being made for the immediate setting out of 300 to 400 additional acres of vines. From 300 to 400 boxes of Malaga grape raisins have been made this year, as an experiment, and are said to be of unusual size and flavor, and superior to any in the market. Don Mateo Keller, one of the largest wine-makers of Los Angeles, has expressed 100,000 gallons of pure juice this season. The San Francisco *Commercial Herald* states that the total shipments of domestic wines from that port to New York from the beginning of 1868 to about the first of July of the current year, were 848,637 gallons of all grades.

Of this quantity the United Anaheim Winegrower's Association shipped 237,600 gallons. G. Groezinger's shipments averaged $40,000 per annum, and the proportions were two thirds white or hock, and one third port, angelica, sherry, muscatel, etc. The usual prices charged were, for white or hock, 50 to 70 cents per gallon; port, $1·25 to $1·50; angelica, $1 to $1·25; sweet muscatel, $1 to $1·50; sherry, $1 to $1·50. I. Landsberger & Co. shipped 2,500 cases of champagne, 4,000 cases and 40,000 gallons assorted, besides 250 cases of wine bitters. Kohler & Frohling shipped about 120,000 gallons. The Lake Vineyard Wine Company consigned 45,577 gallons of port, 24,826 gallons of angelica, 40,353 gallons of white, 31,147 gallons of claret, 4,071 gallons of sherry, 8,758 gallons of grape brandy, etc. There were several smaller shippers whose consignments are included in the grand total above given.

CALIFORNIA COTTON.—A scientific expert in cotton states that the cotton grown from Alabama seed in Merced county, Cal., this year, compares favorably with Brazilian and Egyptian cotton, and is superior to the best Southern upland for spinning purposes. He asserts that the effects of the dry and equable climate of California is an improvement in the staple yielded from the same seed as planted upon Southern uplands. There are large sections of the State well adapted to this culture.—*From the U. S. Commissioner's Report for November and December*, 1870.

### The Iron Trade.

A convention of the representatives of thirty-one out of forty-eight blast furnaces in Western Pennsylvania and Eastern Ohio was held at Sharon, Pennsylvania, on December 29, 1870, to consider the interests of the business. The call for the convention stated that its object was to take into consideration the best means of obtaining a reduction in the prices of Lake Superior ores, dockage, lake and railroad freights, and labor at furnaces, so as to produce pig iron at less cost, in order to meet competition. It was also stated that unless a considerable reduction in the cost of ore and labor can be secured the iron furnaces will not yield a profit to the owners.

At the convention one of the members asserted that not even four or five of the Monongahela furnaces are making money. It was contended that the railroads charged too high freights, and that the dealers in ore at Cleveland charged two and a half per cent commission, while one per cent would be ample. It was also argued that the furnace men ought not to be compelled to pay for the ore with four months' notes until it is delivered, and that the present plan of dating the notes from the time when the ore was contracted for was unjust. Complaints of short weight, amounting to four per cent, were also made. Suggestions were made that an iron clearing house, to manage business at an expense of $28,000 a year, should be established. Nothing definite, however, was determined, but committees to examine into the above-mentioned subjects were appointed, with directions to call a mass meeting, to be held in Cleveland next February.

### Woolen Rags and Shoddy.

Some thousands of tuns of rags are collected in England and thousands more imported. In the manufacture of shoddy, the careful cutting and sorting and the proper classification of the various qualities of rags is the most important stage; for this great experience is required. The mechanical department is supplied by washers, rag-tearers (vulgarly called devils), and scribbling engines. The washer is of the same description as a flock engine or grinder. The rag-tearer consists chiefly of a large cylinder, the surface of the circumference of which is covered with teeth, spiked coarse or fine, according to the rag to be torn. The scribblers are machines used in opening wool. The price of woolen rags depends upon the precise kind of woolen rag; from £5, with intermediate prices, to as high as £70 and £80 per tun are given. The manufacture of flocks and mill pulp is generally carried on with that of shoddy. In Yorkshire shoddy mills are legion; in Gloucestershire there are many.

### Precautions Against Fire in Paris.

As soon as the investment of Paris was completed, the authorities took measures for preventing the destructive effects of shelling. Bills were printed and affixed to almost every house with directions for stopping the fire set up by the bursting of shells. Large tubs filled with water were placed on every floor of the large houses and private buildings. Although covered carefully with canvas, the water, having been left for weeks and weeks, became corrupted and fetid. Proper instructions were given for stopping the infection by the using of charcoal. Two of these tubs are placed in the hall where the French Academy held its sittings, and two others in the *Salle des pas perdus*, by which visitors and members are introduced to it.

HEATING BUILDINGS.—Some one has wisely said: "Instead of asking ourselves with how little fuel can I warm my house? the question should be, How much can I afford to pay for fresh supplies of air, moderately and equally warmed, and distributed without waste?" Instead of this, says the *American Builder*, most of our friends are making arrangements for stopping the flues where no fire is kept, in order to keep the heated air in. If you have a grate in your room, in which you do not need a fire, be assured that it will, if left open, carry off more impure air, which you would otherwise breathe, than you are aware, and that the sum of your health and happiness will be greatly increased by leaving it open even during the coldest weather. It is an excellent ventilator, and the extra heat you will require on account of its use may prove much cheaper than the fee of your physician, should you yield to the notion that it must be stopped to keep the warm air in.

PYROXYLINE DISSOLVED IN OILS.—*Xylonite* differs from *Parkesine* in respect of the solvents employed—fixed oils, such as castor and linseed oils, being used for this purpose, as well as wood naphtha, alcohol, and other of the hitherto well-known solvents. In order to render the oils solvents of pyroxyline, it is necessary to heat them previously, then dissolve a portion of camphor in them, after which they become solvents of pyroxyline. This, Mr. Spiller pointed out, is a new fact in science. The cotton used for this purpose was the lowest form of gun cotton, and burnt very slowly on account of its low nitration. The temperature of the oil has to be raised to 300° Fah. in order to dissolve the cotton. The cotton is prepared by immersing it in four parts of sulphuric acid to one part of nitric acid at a low temperature.—*Br. Jour. of Photo.*

NEW REMEDIES FOR BURNS.—Two new remedies for burns are added to the long list. The first is charcoal. A piece of vegetable charcoal laid on a burn at once soothes the pain, says the *Gazette Medicale*, and if kept applied for an hour cures it completely. The second one is sulphate of iron. This was tried by M. Joel, in the Children's Hospital, Lausanne. In this case a child, four years of age, had been extensively burnt, suppuration was abundant and so offensive that they ordered the child a tepid bath, containing a couple of pinches of sulphate of iron. This gave immediate relief to the pain, and being repeated twice a day—twenty minutes each bath—the suppuration decreased, lost its odor, and the child was soon convalescent.—*Medical Press and Circular.*

VERY intimate relations exist between the sun and digestion. Digestion and assimilation become weak and imperfect if the man or animal is not daily exposed to the direct rays of the sun.

## PERPETUAL MOTION.

NUMBER VII.

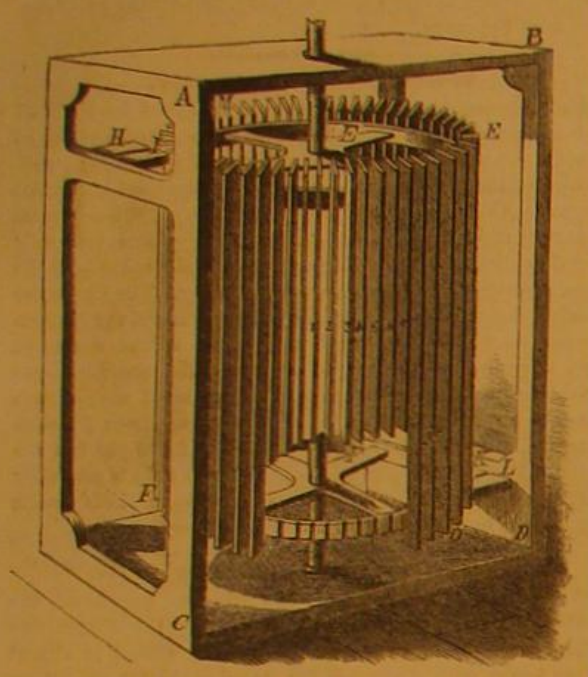
Fig. 15 illustrates a piece of folly, which, we are sorry to say, has been repeated in one form and another so many times that it ought to be considered a standing joke, but which is nevertheless constantly turning up as a serious proposal among a class of inventors who know little or nothing of electricity and magnetism. It is the device of a Dutch inventor, Hero Hicken by name.

A B C D represents a frame of brass or wood for the machine, E F, to run in.

E and F are two brass wheels, similar and equal, fixed upon a movable axis, G.

1, 2, 3, etc., are a number of artificial magnets, placed within the teeth of the wheel all round, and as near each other as is

FIG. 15.




possible, provided they do not touch; their north poles at E, and their south poles at F.

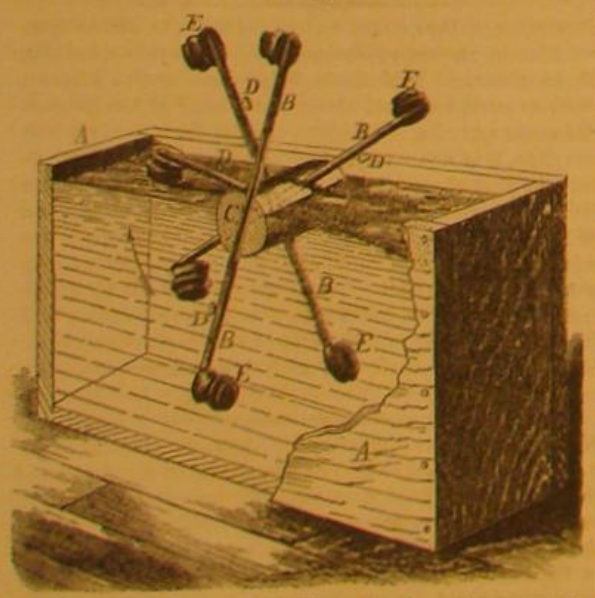
H and I are two similar and equal magnets fixed in the brass plate, A C, very near each other, but not touching.

K and L two more fixed in the brass plate, B D.

Now, as the north pole of one magnet repels the north pole of another magnet, and attracts the south; and inversely the south pole of one magnet repels the south pole of another, and attracts the north; so the south pole, I, attracts all the north ones at M. In like manner, K attracts at N, and L repels at O, and by this means the whole machine, E F is expected to move perpetually round.

Now this would be all lovely if magnets did not attract in more than one direction. Many American inventors have tried the same principle over and over only to find their wheel standing still, and have then sighed for some septum which, interposed between a magnet and its armature, would prevent attraction while thus interposed. The editorial sanctum of the SCIENTIFIC AMERICAN has often been compelled, in answer to correspondence, to confess its ignorance of any substance of which such a septum could be constructed. Humiliating as is the confession, we never have heard of this long-sought for desideratum, and what is more, we expect to leave this sublunary sphere before its discovery. But we do expect, judging from past experience, that about once a month

FIG. 16.




some sanguine inventor, who thinks he has discovered the perpetual motion, "*all but that one single thing*," will expect us to point him the way to success by supplying to him (privately, of course), the knowledge of the septum sought.

This idea of a magnetic perpetual motion is just now the most prevalent one of all, and if what we have said shall serve to open the eyes of the many who are eagerly following what must prove to be only a delusion and a snare, our purpose will be accomplished.

Fig. 16 is an engraving of a supposed self-moving machine sent us by S. H. Davis & Co., of Detroit, Mich. They state that it is the invention of the late William Davis of that city who spent a great portion of his time in the attempt to make a self-moving machine.

A, in the engraving, is a tank containing water, as shown. The hollow arms, B, communicate with a hollow shaft, C, and the bellows, E—screw valves, D, being employed to increase or diminish the area of the passages in the hollow arms, B. Each of the bellows, E, carries a weight, which, during a portion of the revolution, compresses the bellows and forces the air out of it through the hollow arms, B, and shaft, C, into bellows upon the opposite side of the wheel, which, being inverted, are expanded by the action of the weights, and their buoyancy being thus increased on one side of the wheel, the latter is expected to turn constantly by virtue of the effort of the expanded bellows to rise to the surface. This is one of the most plausible devices we have ever seen, and it will puzzle many to conceive the real reason why it will not move as it is expected to do. The fallacy will be, however, apparent to those who are familiar with the laws which govern the pressure of fluids, and who know that whatever buoyant power a body will exert in rising out of a liquid in which it has been immersed, is precisely that which was expended in forcing it below the surface to the point from which it begins to rise.

Says M. De la Hire:

"There is not any of those who pretend to have found out perpetual motion, who do not agree that two weights placed in a position to move, following their natural direction in equal time, or in any way reciprocal to their weight, remain in equilibrium. Yet there is no perpetual motion scheme where one cannot draw a conclusion quite opposed to this principle; for, whatever may be pretended, perpetual motion is nothing more or less than the elevation of one weight to a certain hight by the descent of another weight at the same time; and reciprocally the restitution of the first to the place where it was before its movement, by the descent of the one that had been raised, and so on *ad infinitum*; sometimes by means of weights, which, being raised, in their fall agitate other weights; sometimes, by means of liquid bodies, which, being raised, can run, and move other parts far separated from the center of motion; from which no advantage can be derived, and which is entirely contrary to the preceding principle.

"Those who occupy themselves with this chimera, find nothing but embarrassment, for generally their machines have so many weights, etc., to move them, that their inventors forget always to be on their guard against the many hinderances that arise—the hight, etc., of the powers employed, their natural direction, etc.—all these are sometimes so strangely jumbled together that it requires very hard work to be able rightly to distinguish them. This is one great reason that leads such persons to a false demonstration of perpetual motion; and when they propose their beautiful inventions to those who are versed in science, and who cannot immediately make them see or understand in what way their reasoning is false, they then publish to the world that the very cleverest men have been convinced of the truth of their perpetual motion."

## ANTI-SNORING DEVICE.

Many persons during sleep breathe through open mouth, a practice which, in miasmatic regions, is held to render them much more liable to miasmatic poisoning than if they breathed

entirely through the nose, the hairs on the inside of the nostrils acting in some measure as a filter to prevent the entrance of miasmatic exhalations.

To prevent sleeping with the mouth open, M. F. Pinckard, of New Orleans, La., patented, through the Scientific American Patent Agency, Dec. 15, 1868, the "Sanitary Brace," illustrated in the annexed engraving. Its operation is sufficiently plain without further description, and it effectually prevents the dropping of the jaw and the opening of the mouth during sleep. It has also been suggested that the device would be a preventive of snoring, as it is asserted from the same source, that people do not snore when the mouth is closed.

### The Hartford Steam Boiler Inspection and Insurance Company.

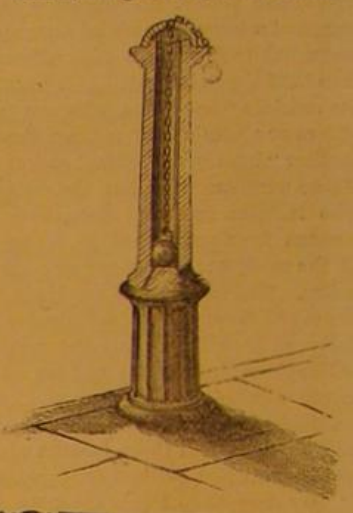
The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections for November, 1870:

During the month 457 visits of inspection have been made, and 885 boilers examined—787 externally and 271 internally, while 126 have been tested by hydraulic pressure. Number of defects in all discovered, 566, of which 64 were regarded as dangerous. Defects in detail: Furnaces out of shape, 18; fractures, 54—8 dangerous; burned plates, 30—8 dangerous; blistered plates, 36—3 dangerous; cases of sediment and deposit, 109—6 dangerous; cases of incrustation and scale, 114—2 dangerous; cases of external corrosion, 34; cases of internal corrosion, 30—4 dangerous; cases of internal grooving, 4; water gages out of order, 51—11 dangerous; blow-out apparatus out of order, 7—3 dangerous; safety valves overloaded, 11—5 dangerous; pressure gages out of order, 64—3 dangerous, varying from —7 to +15; cases of deficiency of water, 4—3 dangerous; broken braces and stays, 26—3 dangerous; insufficient bracing, 8—5 dangerous; boilers condemned, 2.

We have no room for comment, but the record shows that there is great neglect in the management of steam boilers. We hope every engineer under whose eye this record may come, will see that none of the defects enumerated above can be found in, or on, the boilers and connections under his care. There were 13 explosions during the month, attended with fearful loss of life and property. Twenty-five persons were killed and 29 wounded.

## IMPROVED HITCHING POST.

Our engraving shows a recently patented neat, handy, and tasty iron hitching post for horses, designed to prevent them from breaking halters, and to give free play to their heads, while, at the same time, they are prevented from entangling their fore feet with the strap, etc. The ring to which the halter strap is tied is attached to the end of a chain, which chain is attached to a ball or weight in the hollow of the post. A pull on the strap hoists the weight a short distance, and when the strain is lessened, the weight takes up the slack again, and so keeps the strap drawn tight within certain limits.



### Threaded Envelopes.

A new form of envelope has recently become quite popular in Germany, and possesses the convenience of enabling one to open a letter when completely sealed up without the ordinary difficulty of finding an entrance. The arrangement consists in introducing a thread, which projects from one of the corners, by pulling which the lower edge of the envelope is cut through without injury to the inclosure, the address, or the stamp.—*Exchange.*

That is not new to us. Some three or four years ago it occurred to us that a device for opening envelopes would be welcomed by the public, and we prepared one with thread inserted as above described, and sent it to Munn & Co., of the SCIENTIFIC AMERICAN for examination. They wrote to us that a similar invention had been patented and we prosecuted the matter no further. Now it comes out as something new.—*Monmouth (Ill.) Atlas.*

[The above contrivance is very old, and has been many times re-invented. During the past year it has been sent to us perhaps twice a week on an average by inventors residing in different parts of the country, each of whom has solicited our aid to obtain a patent. We have been obliged to inform them that the attempt would be useless, and have advised them to save their money. We think that the statement that the thread envelope is popular in Germany is a mistake. Ordinary envelopes are opened easily enough, and there is no demand for the threads.—EDS. SCI. AM.

## PAINT-POT HOLDER.

In painting the exterior of buildings, the paint pots are usually suspended from the rungs of ladders set up against the side of the building or suspended horizontally to form a scaffold. When, however, the ladder is set up against the side of the building, and the application of the paint requires reaching away to a considerable distance, the suspending of the pot near the brush saves loss by dropping, and time and labor in reaching from the pot to the point of application.

The device illustrated in the accompanying engraving provides for this. The pot is hung to a horizontal bar whose inner end has studs to engage the lower side of a weather-board, and this bar has pivoted to it a forked lever whose lower pointed ends engage the wall.

This device was patented January 8, 1867.

REPRODUCING FADED PHOTOGRAPHS.—The faded print is carefully removed from the cardboard on which it was mounted; and after the removal of all the paste it is rendered translucent by being charged with wax. It is now used as a *cliché* for printing its image upon a glass coated with collodio-chloride of silver, the action of which is intensified by a previous subjection to the fumes of ammonia. After the exposure, further density is conferred by a development with gallic acid and silver. The negative thus obtained is varnished and employed for printing in the usual way.

## Correspondence.

*The Editors are not responsible for the opinions expressed by their Correspondents.*

### Life Preserver for Hotels and other Lofty Buildings.

MESSRS. EDITORS:—While reading an account in the papers of the great loss of life at the burning of the Spotswood Hotel, in Richmond, a very simple and inexpensive means of escape in case of fire suggested itself to my mind, and I give it to you for publication, if you think it worthy of pratical application. Let A in the sketch given be an iron hook of suitable strength to retain its form, and bear the weight of an ordinary man. Let B be a bag of net work, made of rope about the size of a clothes line, and secured to

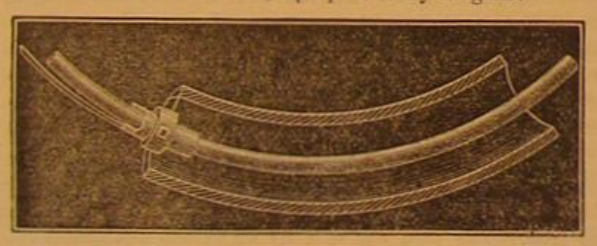
the hoop; and C, a rope attached to the bag, and long enough to reach from a window to the pavement beneath, with slack to secure it to any object in the room, even at a distant point. With an arrangement of this kind in the rooms on the upper floors of a hotel, every man, woman, and child might escape in perfect safety, the last man, of course, would have to slide down by means of the rope itself. The bag ought to be made about 4½ feet high, or perhaps a little above the waist would answer; and in case of infants and children being put in, they would have plenty of air through the open spaces. It will be necessary to use a bag, because being perfectly pliable the party in it could more readily assist in launching himself or herself off the sill of the window; for in case of having to lift out an affair of the kind with its human freight, more strength would have to be brought to bear than person at the top could easily put forth. I have thrown out these hints in hopes that the may lead to the saving of human life, and if of no practicul value in themselves, possibly some one may be thereby induced to bring out an invention that will answer the end in view. HUMANITY.

Baltimore, Md.

### Boring Segment of Hollow Cylindrical Ring.

MESSRS. EDITORS:—In your issue of the 20th of November L. V. asks this question: "Will some practical mechanic tell me how I can bore out true a segment of a hollow cylindrical ring, the segment being the sixth part of such a ring, the diameter of which is two feet, and the diameter of the bore being required to be six inches?"

I sent you what I supposed to be a true plan for the purpose, but in your issue of December 17th you ask me, "Have you not mistaken the drift of L. V.'s query?" In reply I answer, yes. And now, fully understanding your correspondent's wishes or statement, I propose to try it again:



Make a wooden frame, into which fasten the segment to be bored, with the bore down. Place this frame in front of an engine lathe opposite the face plate. Turn a piece of round iron about one third the diameter of the bore of segment, and bend it over a turned circle the same as desired (viz., two feet); pass it through the segment and fasten it to the frame rigidly. In the exact center of the segment on this bent bar or mandrel make a sliding head some four inches long (in halves and rabbeted) so as to move freely through the segment. Feather the same, if liable to turn in the least. In the center of this slide turn a collar, and thereon place a ring with a cutter in the center. Set the cutter out to take a cut, and hold the loose ring with a set screw. Now it is very evident that if you push this slide through the segment you will cut a groove to correspond with the circle of the mandrel. Draw it back and loosen the set screw and turn the ring for a new cut. Tighten with the set screw, and renew the operation until the circle is complete. I propose to use the face plate of the lathe for a crank, and employ connecting rods from the crank pin to the slide for the purpose of driving it. This is an expensive method, but I am sure it is a good one. H. WHEELER.

Silver Creek, N. Y.

[We fear all our readers will not share the confidence our correspondent feels as to the practicability of his method. We see many practical difficulties in the way of getting a true job in the manner specified. However, as it is an attempt to solve a difficult problem, and suggests thought, we give it for what it is worth.—EDS.

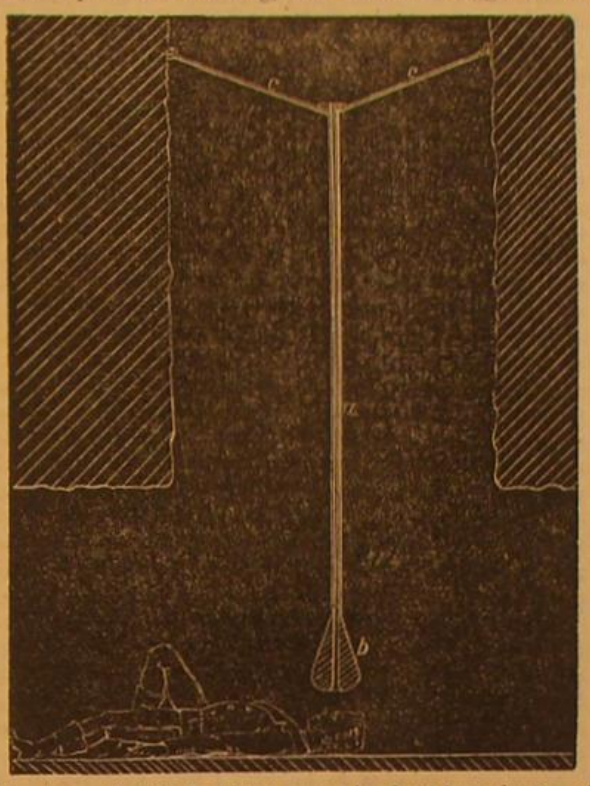
### The Great American Desert a Myth.

MESSRS. EDITORS:—A short time ago I read a short article on the barrenness of the land west of the Missouri River, which conveys a very wrong impression. After over 5,000 miles travel over the plains, mostly on foot, I am thoroughly convinced that there is but very little which cannot be utilized. I was taught in my schoolboy days the magnitude of the great American desert, but, with the exception of the sand bluffs along some parts of the Platte River, and a sand tract about twelve miles wide a little south-east, and about sixty miles from what used to be named the junction on the South Platte, I have failed to find it. All over the plains there are indications of water near the surface, and springs are frequent in the bluffs. As for the soil it is very rich. I am more willing to trust my own eyes than the speculations of others. T. L. VON DORN.

Omaha, Nebraska.

### The Hoosac Tunnel.

MESSRS. EDITORS:—In your issue of Dec. 24th, No. 26, Vol. XXIII., is an article from the pen of G. C. Breed, on the difficulties of getting a correct plumb line, etc., in the Hoosac tunnel. Now, Messrs. Editors, I am not an engineer, but occasionally do some thinking, and this article suggested the




idea to me that if the thing cannot be done from the top of the shaft by a long plummet, why can't it be done from the bottom from a short-sighted one.

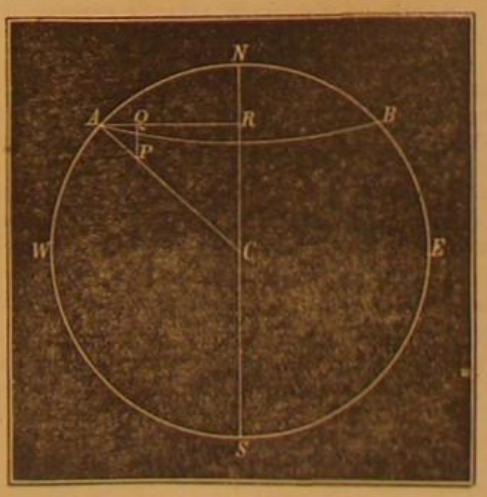
I give you a rough sketch of my idea. We will suppose a rod or tube, *a*, suspended by strings, *c*, or in any other convenient way, in the center of the bottom of the shaft, the rod or tube being hollow or sighted like a gun barrel. Why couldn't a person, looking through it or its fine sights, get the point as it ought to be, either at the top of the shaft or by a star or some other point in the sky.

I do not believe in perpetual motion, or any thing of that kind, but in my experience I find that if a thing cannot be done in one way it is no sign that it cannot be done in another. This suggestion may expose my ignorance, but still take it for what it is worth. CYRUS COLE.

Havana, N. Y., Dec. 24, 1870.

### Can a Perpendicular be Obtained by Means of the Plumb Line?

MESSRS. EDITORS:—As Dr. Heirry's article, in your issue of December 10th, has impressed an erroneous idea upon some of your readers hereabouts, I submit the following for the purpose of enlightening the doctor upon the subject, as well as such of your readers as have been misled by his statements.




The doctor's statement that it has been proved to be impossible to obtain a perfect perpendicular line by means of a plummet is a mistake, which has probably resulted from his not having comprehended the experiment to which he alludes. It is well known that a plummet suspended and caused to vibrate as a pendulum, will, by the motion of its plane of vibration, demonstrate the rotary motion of the earth; and it is also well known that a plummet dropped will strike a point below, eastward (not westward, as stated by Dr. H.) of a vertical through the point whence it was dropped; but these facts by no means prove that a plummet may not be suspended so as to indicate a true vertical line, all of which will readily be understood from the subjoined diagram and explanation.

Let E W N S represent a horizontal section of the earth through its center, and let A B represent a parallel of latitude through A, which may represent the mouth of the central shaft in the Hoosac tunnel in lat. 42°, say L; and let P represent a point at the bottom of the shaft vertically below A; let A R be perpendicular to the earth's axis, S W, and let P Q be parallel to S N. Then, because the earth revolves on its axis, all parts not in the polar axis have an eastward motion in space which is proportional to their distance from the polar axis; therefore the eastward motion of a point at P (which is at the same distance from the axis as the point at Q) will be less than the eastward motion of the point at A. But the point, A, will make a revolution about R in one sidereal day—about 86,160 seconds. Hence, we readily find the difference per second of the velocities of the points, A and P, to be $\frac{2a\,\pi\,cos.\,L}{86{,}160}\,8=0{\cdot}671$ of an inch nearly, *a* being the depth of the shaft.

Now, for a plummet to face through 1,030 feet will require about 8 seconds of time. Hence a plummet would fall to the bottom of the shaft of the Hoosac tunnel in 8 seconds, and consequently it would fall east of the point vertically below the point from which it was dropped, a distance $=\frac{2a\,\pi\,cos.\,L}{86{,}160}\times 8=5{\cdot}37$ inches, nearly.

But if the plummet is suspended in a vessel of oil, for instance, as you suggest, which vessel rests upon the earth at the point, P, it is clear that when the plummet is at relative rest within the oil, it will have lost a portion of the motion it had when at the point, A, and will have precisely the same eastward motion as the point, P, and will therefore be at rest, relative to the oil, when vertically below A.

Des Moines, Iowa. J. E. HENDRICKS.

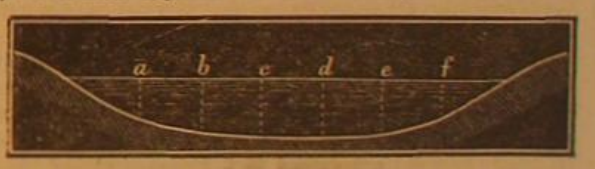
### To Estimate the Power of a Stream.

MESSRS. EDITORS:—Almost every man has about him in his daily walk sufficient apparatus for a tolerably accurate estimate of the quantity of water flowing in any stream. A walking-stick, a jack-knife, and a watch, provided the walking-stick is just three feet long, are all the tools necessary for the purpose.

Take a section of the stream as uniform in breadth and depth as possible, and measure off upon its bank some definite length, say from one to four hundred feet, according to the rapidity of the water; set a stake close to the water at each end of this section, then throw into the water, opposite the upper stake, a green twig or limb of a tree, or other object of such specific gravity as to nearly, but not quite, sink, and of such size that one portion shall remain at the surface while another portion nearly touches bottom; the object being to get the average speed of the water; the resistance caused by the bed and banks of the stream necessitate some care in this part of the experiment.

Note accurately the time the object is passing from stake to stake, and repeat the operation several times and at as many points towards the opposite shore; the sum of the several times divided by the number of points at which the speed was taken gives the average speed of the water.

Now measure the depth at several equidistant points across the stream, as at *a, b, c, d, e, f* (the diagram representing a cross section of the stream), the sum of these depths divided by the number of points at which the depth was measured




gives the average depth; this average depth multiplied by the breadth of the stream gives the area of the cross section, this area, multiplied by the length of the section, gives the cubic contents of body of the water embraced in the section Thus we have the quantity and its velocity, which are the elements necessary to show the value of a stream for manufacturing purposes, provided it has sufficient fall anywhere to render it available.

Allowing sixty-two pounds for each cubic foot of water, and a supply of one thousand cubic feet per minute, and a fall of ten feet, we have $1{,}000\times 62=62{,}000$ pounds, $62{,}000\times 10=620{,}000$ pounds momentum, $620{,}000\div 33{,}000=18{\cdot}7$-horse power. One fifth at least must be deducted for friction and loss, making in this case about 15-horse power. F. G. W.

### Popular Errors Regarding the Watch.

MESSRS. EDITORS:—A hunter's (or close) case is almost universely supposed to be the best protection for the watch; it is also supposed that it prevents the breaking of glasses, that it better protects the movements from dust, and that in all things is the most desirable to have—to all of which I wholly dissent.

Every watchmaker of experience and observation knows that a close case permits more dust and lint to get into the movement than an open one, for the reason that the case over the glass, which springs open on being unlocked by the push in the stem, necessarily fits loosely down on its place, to allow it to open by the force of the lifting spring. If it snapped, like the opposite side, the spring could not lift it open. The dust finds its way inside the cover, through this loose fit, and thence it works its way into the movement through the opening left for the lifting spring to act on the case, and through the opening around the locking spring, which holds the case shut; the hole through the stem, through which the push-pin acts, also permits dirt to pass inside. There is also another trouble in close-case watches, which is, that the lifting spring is constantly bearing upwards on the cover, and every time the case is opened the hinge (joint) is worn a little. After opening many times, the joint becomes much worn, and more or less open, affording an additional place for

the dust to enter. Particularly does this occur when the case is allowed to fly back against the joint with a force proportioned to the strength of the lifting spring and the weight of case, thus adding to the natural wear a stretching open of the joint, that very soon allows the dust to pass in quite freely. All these causes conspire to foul the movement in a very short time.

In the open-faced watch not one of these openings exist for the admission of dust; the rim (bezel) which holds the glass closes with a snap-joint; the back case closes with the same snap, there is no opening through the stems, and the whole case, if properly made, is water-tight, and will remain so for years, thus affording almost perfect protection to the movement from dust.

The serious inconvenience caused by the rapid accumulation of dirt in the close cases, has stimulated inventive genius to devise ways and means to remedy the defect. "Dust rings" thus far have been the only product of this inventive labor; some are placed around the edge of the movement; some go inside the case; neither kind are entirely successful in excluding the dust. The only possible advantage in the use of the close case is, that it may be continued in use after the glass is broken. An open-face watch must be laid up if the glass breaks till another can be had; but only the very heavy cases protect the glass from breakage, and probably three fourths of the close cases in use are supported by the glass, instead of affording protection to it; and particularly is this the case with ladies' watches in which the glass must be flat, and very thin.

There is no doubt but that more glasses are broken by the use of close cases than would be broken if open cases were in general use, the latter admitting of much thicker and stronger glasses. Neither are the very heavy close cases the protection to the movement that many suppose; one sufficiently heavy to prevent being crushed, is well, but all the weight of metal beyond that is dangerous, and for this reason, that in the event of the watch falling, or enduring any sudden jar, the momentum of the massive case produces a concussion which must damage some part of the movement, thus its very strength proves destructive.

For the benefit of the "craft," I advise the use of "hunter's cases;" for the good of the wearer, most certainly "open" ones.

R. COWLES.

Cleveland, O.

### Nitro-Glycerin Explosions.

MESSRS. EDITORS:—In your issue of November 19th, 1870 you refer at some length to the recent explosion of nitro-glycerin at Fairport, Ohio.

In the article referred to you denounce in a very emphatic manner its manufacture and use as a blasting agent. As I have been engaged in its manufacture for two years, and have possibly as much practical knowledge of it as most men, I beg you to allow me space in your valuable journal to vindicate, in some degree, this much abused substance.

In the first place, without attempting to disparage the general accuracy of the report of the Painesville (Ohio) *Telegraph*, further than to call attention to their sensational style of reporting such matters, I will state a few facts in relation to the explosion not generally known, but which, if published, will go far to allay the popular fear of nitro-glycerin.

On the day of the explosion there were 15,000 pounds of the substance in the magazines (equal in explosive force to 195,000 pounds of gunpowder) all of which exploded almost simultaneously. Nevertheless we find by actual facts that its deadly area did not extend to a radius of eighty yards, and that the concussion was incapable of exploding a quantity of nitro-glycerin in an exposed position eighty feet from the nearest magazine. Again, the effect upon the houses in Fairport has been ridiculously exaggerated. Ruinous previous to the explosion, all the dwelling houses, thirty or forty in number (the nearest being about 600 feet from the magazines), have since been put in good repair by an expenditure by the nitro-glycerin company of a sum not exceeding eight hundred dollars.

As to the assertion that the shock was communicated through the earth 160 miles, I think it is simply puerile and unworthy of consideration. For why was not Cleveland, only thirty miles distant, also moved by the shock? The inhabitants in that city did not even hear the report. May not, however, the theory of a simultaneous earthquake be entertained on good grounds of belief? It is on record in the public prints that on the same day and about the same time of the explosion, the shock of an earthquake was distinctly felt in Canada, the States of New York, New Jersey, and Pennsylvania. The working of telegraph wires was in some places interrupted, and many individuals are reported as having experienced the peculiar feeling of nausea which is said to be the concomitant of earthquakes. Taking these circumstances into account you can, of course, draw your own inferences.

In Gainesville (notwithstanding sensational reports) no consternation was caused, and no damage was done. Many people did not even know of the explosion. Others hearing the noise thought it was the firing of a cannon or, perchance, the explosion of a steam boiler.

You refer to the case of a man sick with typhoid fever having been instantly killed by the shock. Dr. Jackson, the physician in attendance upon the man, declared upon oath last week that his patient, previous to the explosion, was moribund, and died some time after the explosion.

Apart from the assumption that this explosion may have resulted from an earthquake, I can easily believe that it may be accounted for thus: The unfortunate men were engaged in removing from the magazines some earthenware jars containing nitro-glycerin in a partially frozen or solidified state, and I assume that one jar must have been let fall upon another accidentally, which, striking against each other with sufficient force, would fully account for the unfortunate occurrence.

I will now, if your space will permit, state my conviction, induced by large experience, that the manufacture and handling of, and the blasting with, nitro-glycerin can be carried on with perfect immunity from danger. During its manufacture I cannot conceive any circumstances under which it may explode. In my experience I have seen at the same time two vessels, each containing six pounds of nitro-glycerin in a state of incandescence, caused by a small quantity of unconverted glycerin lying on the surface of the crude nitro-glycerin. This apparently alarming phenomenon proved to be perfectly innocuous, as on precipitating the unconsumed contents of the jars in water, I found that ten pounds of nitro-glycerin had been consumed gradually and without explosion or instantaneous decomposition. Can a correlative case be quoted as to gunpowder?

Undoubtedly in the safe manufacture and using of nitro-glycerin certain conditions must be implicitly complied with, the chief of which conditions are, persistent forethought and caution. All the employés of the Lake Shore N. G. Company were duly advised on their engagement of the nature of the product, and were well instructed in the mode of handling the same, but "familiarity may have bred contempt;" carelessness may have been the result, and hence the catastrophe.

During the last two years the Lake Shore Nitro-Glycerin Company have manufactured about 150,000 pounds of nitro-glycerin, equal in explosive force to 1,950,000 pounds of gunpowder, all of which has been used for blasting purposes without the loss of one single life. Has gunpowder a similar record? Indeed the very fact that miners were certainly unconversant with the rudimental principles of chemistry, have (taking their safety into consideration) decided wherever it has been introduced, in favor of nitro-glycerin, shows beyond doubt that the dangerous properties of nitro-glycerin are merely hypothetical.

I have been a regular subscriber to your invaluable journal for the last twelve months, yet, notwithstanding that many casualties, through the use of gunpowder, attended with the loss of many lives, have occurred during the same period, I have not seen that you have censured those manufacturing or using it.

Since the explosion in Fairport I have observed in the public prints that in various parts of this country and in Europe seventy people have lost their lives and many more been injured by the accidental explosion of gunpowder and gun cotton, all of which you pass by without comment.

In conclusion, may I venture to suggest to you that it is impolitic, not to say unfair, to decry and condemn any branch of national industry simply because some serious accidents have occurred in its development.

Look back through the histories of gunpowder and the steam engine—two of man's most indispensable servants—and note the black record of death upon their pages, and then say if nitro-glycerin deserves the anathema you have hurled against it.

SAMUEL THOMPSON,
Chemist to the Lake Shore Nitro-Glycerin Co.

Painesville, Ohio.

[We are always willing that both sides of a question shall be heard. In this case we allow an advocate of nitro-glycerin to speak with peculiar satisfaction, since we think every candid mind will, upon reading his communication, rise with strengthened belief that nitro-glycerin is too dangerous a substance for general and indiscriminate use. Since the explosion at Fairport another man has been blown to atoms at the Hoosac Tunnel, and the black record will keep increasing so long as nitro-glycerin is used as a blasting agent. Only such exigencies as rarely occur in engineering work should, in our opinion, justify the use of this deadly explosive. Our correspondent's theory of an earthquake occurring simultaneously with the Fairport explosion strikes us as particularly humorous, if such a thing as humor may be tolerated in so serious a matter. So far as we have been able to learn from the accounts of the many disasters caused by such explosions the earth has in every case literally quaked at the power of an agent that can instantaneously annihilate human beings so that no trace is left of them.—EDS.

### Chemistry in Relation to Practical Agriculture.

MESSRS. EDITORS:—A writer of great intelligence in a recent number of a prominent agricultural journal in Richmond, Va., declares his conviction that science, and especially chemistry, does not aid practical agriculture? *Per contra*, the statement of one fact may illustrate the fallacy of his conclusion more briefly than his argument to "prove a negative":

This farm has been in the possession of my forefathers for more than one hundred years, and during all of that period a bed of peat has occupied a central and comparatively elevated position. Moreover, since my boyhood here (during more than forty years) some of the best practical farmers in Delaware have rented it, and never paid, on an average, a sufficient amount to equal the rent of my dwelling in Baltimore. Since 1865 one half has increased in productiveness, yielding last year an income of $7,000, and an aggregate of $14,000 during the preceding three years, and I depend on this peat to make the other half equally productive and indirectly sustain the crop as above. Its value, however, was not ascertained until last summer, and then as one of the first essays in analysis of my son, which I subsequently verified. We both agreed that the nitrogen or quasi ammonia, when valued at the same rate as we pay for it in Peruvian guano, would pay for excavation, although associated with more than seventy-five per cent of water—in proportion to the carbonaceous residue or magma or solid part of the peat. Still our estimate of the phosphoric acid potash and lime indicated a money value of these elements alone in each tun of 2,000 pounds, worth $3·79, including the ammonia. After more than twenty years' experience in the analysis of soils and marls for others in Maryland, I now testify to the practical importance of such results on my own farm, having devoted my attention to it as a much more certain and profitable investment of my time and acquirements than the laboratory, although that was a success and decidedly so.

DAVID STEWART, M.D.,
Formerly Chemist of Maryland State Agricultural Society, etc.

Port Penn, Del.

### To Put a Grain Mill in Order.

MESSRS. EDITORS:—ADJUSTING THE SPINDLE.—First see if the cock-head and spindle-neck be true; if not, take the spindle out and adjust it. Put the cock-head in a female center, in the dead head of the lathe. Turn the neck true, then run the neck in a suitable bearing. Gland the spindle to the face plate, run the dead head back, and true the cock-head with the center out.

FITTING THE DRIVERS.—Turn the runner or upper burr back down. Draw a chalk line through the center of the burr and through the center of the recesses in which the drivers work. Then draw another line (which we will call A) at right angles or square with the first line, passing over the center of the burr and cutting its circumference into four equal parts. Turn your spindle head downwards with the driver on into its place. Wedge the drivers hard up with hard-wood wedges on which it will press when running. Put on your jack or radial arm and file the pressing faces of the driver till the point in the jack stands equidistant from the face of the burr at both ends of the line, A.

LEVEL THE BED STONE true in all directions with a good spirit level. Put in your spindle and tram it true to the leveled bed stone.

BALANCING THE RUNNER.—If the back is much out of true it will look a great deal better to turn it. However, it can be balanced without turning. You can either face off your burr with sand and water and turn it while this is going on; or you can run the burr up about three fourths of an inch and put in two pieces of hard wood dressed true, 6 inches wide by ¾in. thick. Bring your runner down nicely till it takes the oscillation of the burr without grinding the wood. After you have turned the back, take out the wood. See how much weight it will take, placed on the very verge of the back, to bring it to standing balance. Place the same weight on the same light side on the edge of the burr, down as near the face as possible. Run up to grinding speed; either mark the back with a pencil or the face with a lath dipped in red paint. If the originally heavy or opposite side now trails, move your band and balance a little nearer to the cock-head till you find the exact point where it will be both in running and standing balance. If, on the other hand, the light side still trails, or if the trail has moved to right or left, or "quartered," put more weight over the trail on the lower edge of the burr near its face, and exactly the same weight on the top or back of the burr on the opposite side of the circle, as much as will bring it to balance. It will then be in balance, standing, and at all speeds.

CONCLUDING REMARKS.—In order that the intelligent mechanic may know the theory as well as practice of balancing, let him fancy a pair of governor balls, one of wood and one of iron. The iron one will fly up to the horizontal line quicker than the wooden one; and suppose these balls are inverted (turned upside down), the iron one will come down quicker and press harder than the wooden one. From this it will be seen that the cock-head is the center of suspension for the balancing forces, and that you cannot put a burr in standing and running balance by operating on the back alone. You can put it in running balance at one speed, and then you can put it into standing balance on the neutral ground of the plane of the cock-head.

JOHN W. HOPKINS.

Wilmington, Del.

### Dualin, the New Explosive.

MESSRS. EDITORS:—I notice an article in the SCIENTIFIC AMERICAN, page 401, Vol. XXIII, in relation to the experiments made with dualin at the east end of the Hoosac tunnel, in which your correspondent wrongly informed you about the strength of it. Lieut. Dittmar, the inventor, brought 1,500 lbs. here Nov. 28th, which I used on our 8 ft. slope with good success. I have used over 1,000 lbs. of dualin here since Dec. 1st, and am confident that it possesses the full strength of nitro-glycerin, besides being perfectly safe for any ordinary blaster to handle. It will not explode by concussion, and can be tamped as hard as powder with perfect safety. I see no reason why it will not eventually entirely supersede common powder for all blasting purposes.

H. G. HOLDEN,
Supt. east end of Hoosac Tunnel.

Dec. 30, 1870.

### Why Mainsprings Break.

MESSRS. EDITORS:—On page 372, last volume, of the SCIENTIFIC AMERICAN, Mr. Henry Hollinshed, Jr., of Camden, N. J., attempts to solve the mystery of the breaking of mainsprings by stating that they are wound up too tight around the arbors, and that in this state contraction breaks them.

If Mr. Hollinshed is conversant with watches, he must know there is a stop attached so as to prevent the spring from even being wound tight around the arbor, or strained to its full capacity, and also to prevent its running down beyond a certain point. But it is a practice among watch repairers or

watch spollers to forget to put these stops back after taking a watch apart, so as to get plenty of jobs in putting in new mainsprings. This is one of the radical causes of mainsprings breaking, as the spring is in that case sure to be overtaxed. Springs are also sometimes unequally tempered. In this case the weak point gets continually weaker until it finally breaks. Most generally this occurs soon after winding, because at that time the spring is strained most. C. H. PALMER.

New York city.

### Something about Lavas.

Lava is seldom seen in a state of complete igneous fusion, but consists of crystals, or granules, in a fused paste, and its fluidity is, in a great measure, due to the steam with which it is permeated. The flows of lava vary very much in extent. We may quote two cases, in the first of which an area of fourteen miles by six miles was covered, and in the second an area of fifty miles by fifteen miles was covered to a depth of 500 ft. When we consider that the mass of liquid stone in the last instance far surpasses the magnitude of Mont Blanc, we may form some idea of the extent to which the face of the country would be altered, even by an ordinary eruption; and, in such a case as this, the lava would probably continue to flow for more than a year. Owing to the expansion of the elastic vapor in it, lava is often vesicular, or porous, and, when these vesicles, or hollows, are filled up by minerals deposited from the water percolating the mass the lava is called amygdaloid; and when single detached crystals are scattered through a compact base, or large crystals through a fine-grained base, the lava is known as porphyry, and the rock is said to be porphyritic. Lava, also, sometimes assumes a columnar structure, of which the well-known "Giant's Causeway," in Ireland, is a good example. Besides these formations lava is often forcibly injected into cracks in other rocks, forming what are called "dykes," or walls; the adjacent rocks are very much altered, both in form and construction, by the exceeding heat of the melted lava injected into them.

Igneous rocks, are without exception, composed of silicates of magnesia or alumina, and may be classified under three heads—Volcanic, Trappean, and Granitic. Volcanic rocks differ among themselves in being made up of different minerals; they also differ very much in texture. Some are crystalline (or granular), some compact, and some glassy. The mineral constituents of the granular rocks are easily determined by simple inspection, while those of the compact rocks may be discovered by chemical analysis.

Volcanic rocks, or lavas proper, may be classified under three heads—Trachyte, Dolerite, and Trachy-Dolerite. Trachytes are so called from the Greek word "trachys" (rough), because they have a rough, prickly feeling when handled. In appearance they are generally pale-gray or white, though they sometimes assume a dark-gray and nearly black aspect. They are composed principally of a feldspar, which is rich in silica, but the different varieties vary both in composition and appearance. The trachyte, properly so called, has either a fine-grained or quite compact texture, a harsh feel, and a cellular appearance. In color it varies from pale to dark gray, and is sometimes reddish, from the presence of iron. Of the many varieties of trachytes we will only mention two—Volcanic glass, which is the vitreous condition of a trachytic rock, resembling coarse bottle glass in appearance; and pumice, which is the cellular and filamentous form of the foregoing. Cellular pumice is dark-green in appearance, with less silica than alumina, while the filamentous is richer in silica, and white in appearance. Pumice is, in fact, the froth of lava, and although when powdered its specific gravity varies from 2 to 2½, yet it will float in water, owing to its porous character.

Dolerites or hornblendic lavas are so called from the Greek word "*doleros*," deceptive. They are usually of a dark green or black color, becoming brown on the surface, when exposed to the weather. They are generally heavier than the trachytes, containing less silica, and more of the heavier hornblendic minerals. The dolerite itself is of a dark gray color, and of a granular crystalline structure; and besides the main ingredients, silica, magnesia, and alumina, a considerable proportion of iron and lime enter into its composition. The two chief varieties of dolerite are anamesite and basalt. Anamesite is only a fine-grained dolerite, so fine grained that its granular texture is only just perceptible. It forms the connecting link between dolerite and basalt, which is a compact and, to all appearance, homogenous black rock. It often contains crystals of hornblende and magnetic iron, and is sometimes vesicular or amygdaloidal. It is for this reason that the "Giant's Causeway," in Ireland, has sometimes been called an anamesite, though generally considered to be a basalt. The trachy-dolerites or, as they may be called, intermediate lavas, do not, from their very nature, admit of any accurate definition. They consist of an almost intimate mixture of the two foregoing species of rocks, the minerals of each blending together so that they can scarcely be distinguished. Besides these regular lavas or volcanic rocks, there is the volcanic ash, which consists of the ash mixed with fragments of lava ejected from the crater of a volcano during eruption. This so-called ash often greatly exceeds in bulk the streams of lava. A tract of country, with a radius of 25 miles, has sometimes been covered to a depth of ten feet, and the lighter ashes may be carried 600 or 700 miles by the wind. The degree of consolidation of these materials varies very much, and depends upon the circumstances under which they were ejected. Sometimes they remain loose, and sometimes form a solid rock. If they are ejected upon land, they may be consolidated either by their own weight, or in consequence of the percolation of water derived from rain falling with the ashes, or subsequently gaining access to them. As an example of this we may say that the ash which fell on Herculaneum was mixed with water, and is, consequently, much harder than that which covered Pompeii. If the ash falls into the sea, it becomes consolidated in a manner precisely similar to the mechanically-formed aqueous rocks already treated of, and often contains fossil shells.

### Air Holes in Ice.

Mr. John Langton, of Ottawa, Ontario, in a very interesting communication to *Nature*, upon the "Prismatic Structure of Ice," thus speaks of the formation of air holes:

"There are also some curious facts connected with the air holes which form themselves during winter. There are often particular spots where partial openings in the ice will be formed every winter. These I conceive to arise from warm springs, and to have no connection with air holes, properly so called, which are not confined to any particular locality, but may appear anywhere. There is always a good deal of air under ice, and you may often see it scattered about in small bubbles when the ice is thin. It is probably air excluded in the process of crystallization, and when there is added to it sundry gases formed from decaying matter in the water, it amounts, during the winter, to a considerable quantity. Such collections of air, like the bubble in a spirit level, are in a very uneasy condition, and are rapidly transferred from one place to another on any casual disturbance of the level, giving rise to one of the numerous noises which are always, more or less, heard on a lake covered with ice—at least, we used always to attribute to this cause a peculiar groaning sound, which was very common. Now, if there should be any casual inequality in the lower surface of the ice, the air will naturally collect there, and if it is above 32° F., which, in so far as it consists of evolved gas, it probably will be, the receptacle will be increased by thawing. A dome-shaped cavity will thus be gradually formed, which will finally reach the surface; air will escape from below, and the surface water, of which there is almost always more or less after the snow has fallen, will run from above, wearing the little jagged channels, which are characteristic of air holes. The whole thing will then, after a while, freeze up again, leaving an indication of where the air hole has been in the different color of the freshly-formed ice. I have tried several such air holes with an axe, when first formed, and have always found them to lead to such a dome-shaped cavity. I remember, on one occasion, an otter frequenting a large air hole which remained open for some time, and which must have been from a mile and a half to two miles distant from the nearest open water. How did he reach it? for no otter can travel that distance under water without access to air. The Indians say they will go to greater distances still under the ice, and that they will always find air there. It is likely enough that there may be many such dome-shaped cavities, which have not yet reached, and may never reach, the surface as air holes, but one would imagine the air they contain to be not of the most wholesome character. However, this otter did frequent that air hole for about a week, which it certainly did not reach by traveling on the ice; and though it had few chances of breathing there, in the daytime at any rate, it contrived during that period to elude the snares of a white man and an Indian, who wasted a good deal of time in looking after it.

"So far, the process of the formation of air holes, if I am right in my explanation, is intelligible enough; but sometimes they are formed in a manner which is difficult to account for. Upon one occasion I had crossed the lake to a friend's house, about four miles off, and we had determined to start together next morning to our nearest town, but I had to go home first. I first went over by daylight, when there certainly was nothing unusual in the appearance of the ice, which might be four or five inches thick at the time, with a slight sprinkling of wettish snow on it. I returned home about eleven at night, and, as it was bright starlight, with only a few floating clouds, I should have noticed any change; but I came straight across, and saw nothing to attract attention. But when I crossed again at daylight in the morning, in one part of the lake the whole surface was covered with air holes; there must have been hundreds of them. At first I gave them rather a wide berth; but, on approaching one to examine it, I found it frozen up again, the clear ice in the hole, with very slight indications of the characteristic jagged edges, being the only sign that there had been an open air hole there during the night. I had no axe with me to try whether they were connected with any cavity, but the appearance was as if holes of from two to five or six inches in diameter had been punched through the ice. Of course, we attributed it to electricity, as people will do anything which they do not otherwise understand, and I have never been able to give any more intelligible explanation of the phenomenon. There certainly had been some faint sheet lightning that night, a very unusual thing in winter; but what connection, if any, there may have been between the two things, I cannot say."

### Method of Searching for Diamonds.

There is little doubt that diamonds exist in many places as yet unknown, or where their presence is unsuspected. Gold is discovered readily in auriferous regions, even by those who are inexperienced at the work, but the diamond is far less easily detected. It is very difficult for the unpracticed eye to distinguish it in its natural condition from crystals of quartz or topaz. One, therefore, who has no experience in diamond seeking may see, and even handle, such gems without recognizing them or even suspecting their value. It was in consequence of the geological knowledge of Humboldt that the diamond regions of the Ural Mountains, in Russia, were first discovered. At his suggestion the gold washers were directed to search for diamonds before they had been found or any suspicion raised of their existence. From that time to the present the finding of diamonds there has become frequent.

The color of the gems constitutes the main difficulty in detecting their presence. They, in fact, are of various shade and hues, as yellowish brown, green, blue, and rose-red, and very closely resemble the common gravel by which they are surrounded. The finest, however, are of no color at all, and are to the inexperienced diamond seeker identical in appearance with transparent quartz crystals.

In Brazil, where great numbers of diamonds, chiefly of small size, have been discovered, the method of searching for them is to wash the sands of certain rivers in a manner precisely similar to that employed in the gold fields of Australia; namely, by the aid of prospecting pans. A shovelful of earth is thrown into the pan, which is then immersed in water, and gently moved about. The result is that the contents are converted into a kind of thick, muddy slush, from which the stones are picked out by the hand. As the washing goes on the dirt and sand are gradually disposed of, and the pan contains apparently only about a pint of thin mud. Great caution is now observed, and ultimately there remains only a small quantity of sand. The diamonds and particles of gold, if haply they are present, sink, by virtue of their great specific gravity, to the bottom, and are selected and removed by the practiced eye and hand of the operator. But how shall the gems be detected by one who has had no experience, and who in a jeweler's shop could not separate them from quartz or French paste? The difficulty can only be overcome by testing such stones as may be suspected to be precious. Let these be preserved until the day's washing is over, and then tried by the very sure operation of attempting to cut with their sharp corners glass, crystal, or quartz. When they are too minute to be held between the finger and thumb the specimens may be pressed into the end of a stick of hard wood, and run along the surface of a piece of window glass. A diamond will, in such case, make its mark, and cause, too, a ready fracture of the glass in the line over which it has traveled. Tested in a similar way upon a crystal of quartz the diamond will make such an impression as no one crystal can have upon another. But a yet more certain and peculiar characteristic of the diamond lies in the form of its crystals. The sapphire and the zircon will readily cut glass and scratch quartz, but they have not the curved edges of the diamond. In small crystals this peculiarity can only be observed by using a magnifying glass, but it is invariably present in the true gem, whether it be large or small. It is, perhaps, rare to find a diamond with four curvilinear faces, but such a circumstance places its identity beyond the domain of doubt. Another form of diamond is that of the octahedron, or eight-sided solid, with the edges replaced by interrupted narrow convex surfaces. Such interrupted, convex, or rounded angles are sure indications of genuineness. The diamond breaks or is scratched with difficulty, and hence a test sometimes employed is to place the specimen between two hard bodies—as a couple of coins, for example—and force them together with the hands. Such a pressure will crush a particle of quartz, but the diamond will only indent the metal. Thus much of practical information for the service of the diamond hunter of the Cape; and now, supposing a successful issue to his exertions, let us say a word or two as to the mode of estimating the value of diamonds. They are invariably valued by the carat, which is four assayer's grains. The estimate is made by squaring the number of carats, and multiplying the result by the price of a single carat. The price, it will thus be seen, increases in a multiple proportion to the weight. The actual price of a small, rough diamond, fit to be polished, is about £2 per carat. One of two carats is worth, therefore, 2×2—4×2—£8; one of four carats, 4×4—16×8—£128. The value increases by both size and color—or water, as it is termed.

When diamonds are cut and polished they are known to jewelers as brilliant, rose, and table diamonds, depending on the form and number of the artificial faces. Diamond cutting is chiefly done in Holland, on wheels of iron or copper, and with the agency of the dust of inferior diamonds, known as diamond dust. A set diamond may be tested by placing wax on its back. The luster of a true gem will not be affected by this operation, while the spurious brilliancy of paste imitations will be totally destroyed by it.—*Mechanics' Magazine.*

### Unhealthy Foundations for Buildings.

Two learned doctors, says the New York *Mercantile Journal*, have disagreed (a thing not unprecedented in history) in regard to the cause of the recent unhealthiness in Liverpool. Dr. Stallard, who has made a report on the subject, attributes it to the filling in of the brick-pits with refuse, consisting of ashes, fish bones, lobster shells, cabbage leaves, potato parings, old door mats, broken pottery, and other things, too numerous, as well as disagreeable, to be mentioned, which the drainage of the sewers will not remove. He affirms that no house can be healthy built on such a sub-soil, and that sewers must inevitably be filled with noxious gases, so long as such a state of things exists. To whom Dr. Trench opposes the opinion that, as a physician and chemist, he sees no reason why the materials named should not, if left undisturbed, be decomposed without the evolution of noxious gases, to any injurious extent, and the products of decomposition become a good and firm, though porous foundation; the latter quality rendering it a more healthy foundation than the clay upon which the greater part of the city stands. The Health Committee of the city, in view of these conflicting opinions, have resolved to refer the matter to Professor Huxley, requesting him to name two competent scientific men to investigate the matter thoroughly. The report which will be made will be looked for with interest, as this is a sanitary question of the first importance to all cities.

### Improved Steam Gage.

On page 375, volume XXIII., of the SCIENTIFIC AMERICAN, in an article headed "Safety *versus* Economy in Steam Boilers," we expressed our opinion that "unsafe boilers should be legislated out of the market, if possible," etc. Since we thus wrote, the daily journals have given accounts of several sad disasters from "Boiler Explosions," on land and water, which are doubtless to be attributed either to imperfect construction, or to the unfaithfulness or incompetency of employés—provided the owners themselves were not in fault, from unworthy pecuniary considerations. Not seldom do the latter force their employés to use apparatus which they know to be extra hazardous, or of the safety of which, at least, they have no assurance. We feel justified in the inference that the party who sells and the one who buys a boiler second-hand, for one fourth its first cost, cannot be ignorant of the probable existence of defects from which serious consequences may result. If, however, they persist in the use of such boilers, they endanger lives and property criminally.

We also stated in the article alluded to, that it is somewhat difficult to frame a law the enforcement of which would secure proper care in the attendance of boilers, and their usual attachments, or to conceive any system of legal inspection which would be sufficiently stringent with one class, without having conditions that would be onerous in their bearing upon others.

Such being the case, we must look for some mechanism to be used in connection with the various adaptations of steam, both as a power and in its general application as a vehicle for transmission of heat, which will afford greater security to the public against foolhardiness, presumption, ignorance, and irresponsibility.

Pertinent to this subject, we present to our readers an illustration and description of Edson's Recording Steam Gage, an invention which received the first premium at the late Fair of the American Institute, and which seems to meet a long-felt want. This instrument will doubtless be as fully appreciated in its practical use as it already has been in anticipation. We have evidence that the charts, or steam-written "logs" it affords, are considered by the life, fire, and marine underwriters, as reliable vouchers of the care exercised by those in charge of steam, and that they consequently are valuable to them in determining risks which they assume. If, as is claimed by the inventors (who have been several years secretly perfecting these steam gages, before submitting them to public inspection), these instruments shall prove to be more reliable for accuracy in denoting the steam pressure than the gages heretofore used, in addition to their recording features, users of steam will not fail to discriminate in their favor. A watchman of this kind will supervise machinery and workmen with more fidelity than many a living watchman. An alarm gong is continuously sounded when any limited pressure is exceeded.

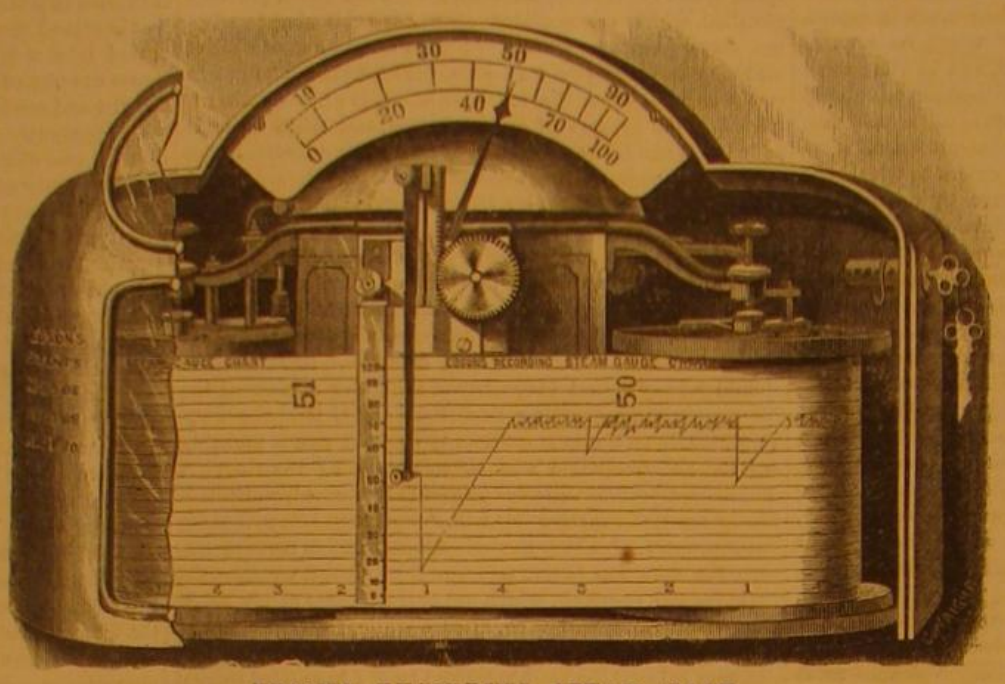
One of the charts will last for several months, and portions may be removed from time to time and filed away for future reference. The cut needs but a brief description. The steam enters by an ordinary pipe coupling into a series of circular, horizontal chambers, placed behind the pencil bearing, and by expanding, the former is made to operate the gear, causing the pencil to move upward in proportion to the degree of steam pressure, and ringing the alarm when the previously fixed limit is reached. The reverse movement of the gear, produced during the reduction of pressure, moves the pencil downwards, simultaneously with the rotary motion (given by means of a horizontal rack and lever operating a pawl within the upper rim) of the receiving drum, and, in consequence of the motion thus given to the chart, the pencil is made to trace an oblique line, invariably in proportion to the fluctuation or reduction of pressure. A vertical line always denotes degrees of increasing pressure.

The chambers consist of pairs of corrugated steel disks, each disk, as well as the other motive parts, being nickel-plated, to prevent them from corrosion, even in a saline atmosphere.

The vertical scale is placed at the left of the pencil, as a guide for the chart; also for greater convenience when marking the pressure upon the chart, previous to its removal. The charts are divided into sections, numbered consecutively "50," "51," etc., the sections being sub-divided into four parts, marked 1, 2, 3, 4.

The instrument is secured with a combination lock, and may be placed in the cabin of a steamer, or office of the commander, as well as in an engineer's or superintendent's room, when required. It is adapted to locomotive, stationary, and marine boilers, of high or low pressure, and to any vessels sustaining internal pressure, as gas receivers, stills, soda fountains, etc.

It was patented in the United States May 5, 1868, Aug. 3, 1869, and Aug. 16, 1870; also in several foreign countries. Manufactured and sold solely by "The Recording Steam Gauge Company of New York," 91 Liberty st., New York.




EDSON'S RECORDING STEAM GAGE.

### A Queer Capture of Telegraph Apparatus.

At Manheim there is on exhibition a telegraphic apparatus, taken from the French, which is to be sold for the benefit of the captor. It was obtained in the following manner: A certain dragoon of the Baden Guards, by name Muench, with two of his comrades, was sent to reconnoitre as far as the Vosges. They had to pass through the village of Raon l'Etampe, the simple inhabitants of which place had not, as yet, seen any Germans. On the entrance of the three armed dragoons they fled in every direction, with the cry of "The Prussians! the Prussians!" and shut themselves up in their houses. Thus left masters of the town, the dragoons, coolly smoking their cigars, rode to the Town Hall and summoned the *Maire*. He soon came, pale and trembling. They asked him where the Telegraphic Bureau was located. He pointed it out, and they at once went to it, and Muench singly, and in the presence of the assembled City Council, cut the wires, unscrewed the apparatus, and buckled it on to his horse. The three dare-devils then coolly mounted and rode away. The commandant of the place, on learning what had happened, declared that he could not survive the dishonor of having commanded in a town of 8,000 inhabitants, where three of the enemy's men were allowed to enter and work their own will, and shot himself dead on the spot. The apparatus is worth about 600 francs, and was presented to Muench, on his return to camp, by his commanding officer.

### MERRIMAN'S IMPROVED WATER-PROOF DRESS AND LIFE PRESERVER.

The accompanying engravings represent C. S. Merriman's patent water-proof dress and life preserver ready for use, and a detail of the same.

It consists of two parts; namely, pantaloons and coat joined at the waist, so as to be water-tight, by means of a metallic ring and elastic rubber bands, as shown in Fig. 2.

The coat is provided with a hood, which covers the head, leaving an aperture about the nose, eyes, and mouth, which is surrounded by a band of elastic india-rubber.

The neck of the garment is made of a size sufficient to allow the head to pass up through into the hood, which has a lining extending down the back of the neck in such manner as to form an air chamber. When unfolded the air chamber presses upon the back of the head of the wearer, causing a tendency to push the head forward out of the opening, and causing the flexible rubber to be drawn smoothly and tight about the faces so as to exclude water from pressing in.

The front and back of the coat are also lined, and are inflated by means of the tubes shown. Vertical partitions in the middle of the front and back of the coat, and also at the side seams, divide the space between the outside of the coat and the lining into four air chambers, besides the one at the back of the head. The sleeves terminate with rubber gloves, as shown.

The bottom of the coat is provided with an elastic rubber band, three inches wide, and one sixteenth of an inch thick. The inside and lower edge of this band for a width of one inch is left three sixteenths of an inch thick, with the projection on the inside, and square shoulders at the top, as shown in the detail.

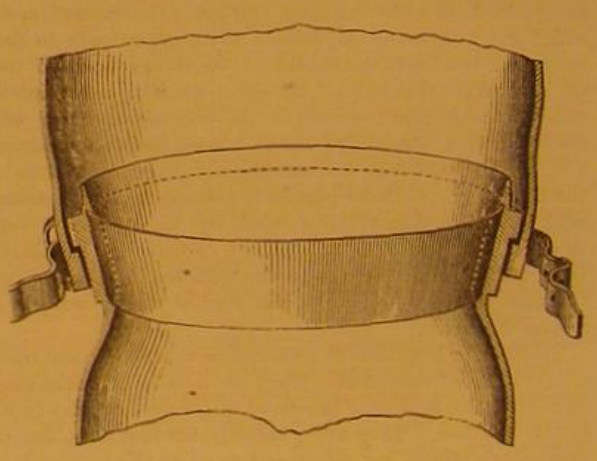
The pantaloons are provided with a ring or band of metal or other rigid material, sufficiently large to pass over the hips of the wearer. Said band is made flaring, with the large side up, and is put between the inner lining and outside material at the top of the pantaloons. A rubber band, two and one half inches wide and one eighth of an inch thick, is then drawn smoothly about, *the first even with its upper edge*, and all firmly cemented together.

The pantaloons are lined down to the knees, and are inflated by means of rubber tubes which pass in at the pockets. The lower portions of the pantaloons terminate with tight boots.

When the coat and pantaloons are joined together, the bottom of the former is drawn over the top of the latter, so as to have the thicker portion of the rubber band on the coat below the thicker portion of the similar band on the pantaloons. The joint then forms a dovetail or lock-joint, as shown in the detail. The whole is now secured by means of a strap buckled tightly over the joint. The strap is secured in its place by small loops or thimbles placed at intervals about the rubber band of the coat.

On the 18th day of October, 1870, the inventor, as we learn from a Western exchange, swam and floated fully three miles in the Missouri River in presence of many spectators. The water was very cold, ice having formed a quarter of an inch thick the night before. On coming from the water he found himself perfectly dry, warm, and comfortable. On the 19th day of December, 1870, he gave an exhibition off the Battery, at New York, with equal success, which exhibition we had the pleasure of witnessing, and from which we formed a very favorable opinion of the usefulness of the device as a life-preserving apparatus.

The dress is convenient to carry, weighing only from ten to fifteen pounds, and when folded, being easily packed in a carpet bag. It can be put on and adjusted in from two to three minutes, and when properly put on excludes the water perfectly. When the dress is fully inflated the body is surrounded with a stratum of air, and lies with the utmost ease upon this elastic cushion. The non-conducting property of this layer of air, and the material of which the suit is made,



keeps the body warm even in a very cold atmosphere. The body floats about one third above the surface, and the head rests on the elastic pillow formed by the inflated hood. We judge from the experiment we witnessed, that, under favorable circumstances, a man in this dress could swim from two to three miles in an hour without exhaustion.

Patented in the United States, August 10, 1869, and subsequently patented in most of the foreign countries through this office. Communications may be addressed to the inventor, Mr. C. S. Merriman, 363 Broadway, New York.

THE lessons of the war to surgical science are beginning to be published. One of the most remarkable facts made known from the hospital reports is that the French soldiers have suffered more from the Prussian shells than from the needle gun and bayonet combined. This is contrary to usual experience, which has reckoned artillery more powerful to frighten than to harm; but it agrees with Napoleon's reported remark to King William at Sedan, as to the marvelous precision of the German cannoneer. It is also said that the needle-gun bullets, though larger than those of the chassepot, do not penetrate the flesh so far, and so make less serious wounds. The sword bayonet used by the French is a much more savage weapon than the old-fashioned triangular blade, which is still retained by the Prussians. Shell wounds are generally found to heal very easily if no bones are fractured

IT is said that in the Antarctic seas there are sea weeds which have stems about twenty feet high, and with a diameter so great that they have been collected by mariners in those regions for fuel, under the belief that they were drift-wood. They are as thick as a man's thigh.

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## THE NEW COMMISSIONER OF PATENTS.

The President has appointed GENERAL MORTIMER D. LEGGETT, of Zanesville, Ohio, U. S. Commissioner of Patents. He will enter upon his duties immediately upon being confirmed by the Senate. A short notice of the new Commissioner was published upon page 9, No. 1, of the new volume.

## THE PROPOSED FAIR OF THE AMERICAN INSTITUTE IN 1876.

The proposition to hold a grand International Exhibition in New York city, under the auspices of the American Institute, in 1876, on the occasion of the centennial celebration of the birth of our Republic, has long been entertained by the Board of Management, and now seeks tangible shape in a memorial to Congress and a circular addressed to whom it may concern.

The occasion selected for this grand project is very appropriate, and must at once challenge the support and insure the sympathies of all patriotic citizens. We hope that something worthy of the country, and in keeping with the high reputation of the Institute, will be accomplished. Before entering upon a plan of this magnitude it will be well for the managers to agree upon all the details, and to count the cost.

We had occasion, recently, to speak of the importance of scientific administration and to deplore the lack of this potential energy in the public and private affairs of our country; and we are forcibly reminded of this topic when we contemplate the immense undertaking the Institute has proposed to itself. Without rare administrative ability and the services of the best talent of the country, the exhibition is certain to be a failure, and we cannot contemplate its inception without great misgiving.

In a circular, prepared no doubt for the information and instruction of Members of Congress, entitled, "The American Institute and its Mission," we find an interesting account of what the society has accomplished towards the encouragement of American industry. It appears that thirty nine National Exhibitions of the products of our own country have been held since the foundation of the Institute in 1828.

These fairs had small beginnings but they have shown a steady growth, and the last one was the best of all. Considering the limited means at their disposal and the want of a suitable building in which to hold their exhibitions, it cannot be denied that the managers have produced results very creditable to their administration and full of encouragement for the future. The award of prizes, medals, and diplomas, by juries of competent men, has had the effect to stimulate the ingenuity, arouse the emulation, and encourage the competition of inventors, manufacturers, and producers in every branch of industry and the arts. The officers of the Institute have shown themselves able to grapple with an American Fair, and they may possibly be equally successful in the broader field of an International Exhibition. It is upon this latter point, however, that we shall presently have something to say.

The circular speaks of the valuable scientific library of ten thousand volumes, to which the members of the Institute have free access; and of the four clubs now in full operation, the proceedings of which have an enormous circulation throughout all parts of the Union. The American Institute enjoys the rare privilege of having its transactions published at the expense of the State of New York, and in this way the information furnished by the sections is preserved in book form, and can be consulted in every public library of the country. There is no other society in the United States whose proceedings are so extensively read, and in this respect it challenges competition.

We understand that the Institute has in real estate and government securities property of the value of three hundred thousand dollars, and this amount is now steadily increasing from the proceeds of the annual fairs and the interest on bonds. The society makes a brilliant show in the extent of its property and the good it has accomplished. It now becomes a grave question whether it is wise to endanger the estate or risk the usefulness of the American Institute by entering upon a scheme of such proportions as is indicated in the circular.

The hundredth anniversary of our independence can be celebrated by the Institute without an appeal to Congress. It is the obvious duty of the citizens of New York to put up a suitable building for annual fairs and permanent libraries and collections. It is an unspeakable disgrace to us that such an edifice has not long since been constructed and filled with models of machinery and specimens illustrating the material wealth of our country. Congress must not be asked to make any grant for the purpose and ought to refuse it if they are asked. The American Institute can stand on its own merits. If the citizens of New York will not believe in it, Congress cannot help the matter. The first thing to be done is to secure a site and put up a building. The plan of a World's Fair ought at once to be abandoned. There is not land enough to spare on the island of New York, and not sufficient money to put up a building large enough to hold type specimens of the industry of all nations.

The Paris Exposition of 1867 was the last and best of its kind. We shall never see anything like it again. The building covered forty acres of land; the park outside embraced eighty acres more, and there was an island of fifty acres in the river Seine set apart for agricultural implements. There were fifty thousand exhibitors, and the money value of the articles in the Exposition was estimated at one hundred million dollars. And yet in the face of all these statistics the circular says:

"In the hands of the long-tried and experienced management of the Institute, the World's Fair of 1876 will, without doubt, eclipse those of the Old World." The committee who have the matter in charge would do well to follow the example of the English Commissioners, many of whom had served in 1851 and 1862, who, when the question of another World's Fair, in 1872, was proposed, unanimously decided that such a project, in the present age of industrial progress and invention, was impossible, and they have changed the whole plan of decennial fairs into annual exhibitions of specific objects.

The true plan for the exhibition managers of the American Institute, is, therefore, to profit by the teachings of the English Commissioners, and to abandon the idea of an International World's Fair. They will be much more likely to obtain money from our citizens when they ask for a million dollars, than when they come before the public with plans involving an outlay almost as great as the cost of the Pacific Railroad.

## MECHANICAL POWER.

We have often been obliged to correct errors in thought arising from the fact that many of the words used in scientific discussion still do double duty, retaining not only the meaning formerly attached to them in the times when knowledge was comparatively imperfect, but being also used to express ideas obtained through more modern research.

The term "power" is such a word, and perhaps no other in the language leads to greater confusion in thought among those who have not made the sciences of physics and mechanics special studies. It is with the intent to give clearer notions of the proper use of this term that the present article has been written.

In its primary philosophical significance the word power means ability to do any act of volition. In this sense the idea of power is connected with that of will, but the original meaning has been extended to the conditions of change in things animate as well as inanimate. When the conditions necessary for a given effect exist in connection with any body or mass of matter, we say that body has the power to produce the effect. Thus we may say a magnet has the power to raise a given weight of iron, etc. In a passive sense we also use the term, in such expressions as "the retina has the power to receive impressions of external objects." In the general sense of the term, then, power may be defined as ability to cause change, or the ability to be changed, whether the change be the motion of a mass, or the motion of molecule in a mass, or a change of state or condition (if there be any such), which we cannot attribute to motion of matter.

In the mechanical or dynamical sense, however, the word change in the definition of the term power is limited wholly to change of position in masses, or *mass-motion*, and the heat produced by friction. When we speak of overcoming resistance we are only using an expression which means the production of increased motion in masses of matter, or portions of masses, and the molecular motion of heat caused by friction. A vessel sailing through the water has three elements of resistance after attaining its maximum speed, namely, the displacement of water, the displacement of air, and the friction of the air and water upon its surface.

In a static sense the word power is popularly used to express the "tendency to produce motion;" or, in other words, it is used as synonymous with force in ordinary language.

In mechanics, even by some eminent writers, the term is used not only in a general sense as ability to produce motion, or to perform work, but, in a specific sense, as ability to do some particular work under particular circumstances. In this sense it is used in the old saying, that "what is lost in speed is gained in power, and what is gained in speed is lost in power." This is only true when the word power is used in a special sense. In this sense an engine that would pump a tun of water to the hight of fifty feet in one hour, by a succession of impulses, might be entirely insufficient to raise it as a mass, unless a train of wheels or other device be employed to "change speed into power." Yet the power of the engine to perform work is the same in both cases, when the term work is understood in its general sense, as measured by the number of foot-pounds of resistance overcome per minute of time.

We think it is much to be regretted that the use of the word "power" is not restricted in mechanics to its dynamical meaning. Its use as a synonym for force is liable to mislead the mind and cause confusion on points of mechanical science requiring the utmost clearness of conception.

The term "mechanical powers," as applied to the elements of machines—the wheel and axle, inclined plane, lever, etc.—is singularly inappropriate, and has been discarded by some of the best writers on mechanics. No one of these elements is a mechanical power, in any just sense of the term. It is only by the addition of other circumstances that they even become instruments for the transmission of power.

The want of clear conceptions of the distinction between the meaning of the term power, when used in its dynamical sense, and the term static force, or pressure, has led to more absurdities than any other error in mechanical science. Some of these absurdities are apparent in the series of articles on "Perpetual Motion," now appearing in this journal.

## OBJECT TEACHING AND SCIENCE.

The public are beginning to be awakened to the fact that technical education is *the* education they require, being in accordance with the conditions of modern civilization; and it is admitted that such technical education must be based upon a foundation of natural knowledge. The principles of the natural sciences must then, for the future, form an essential part of popular education; the only questions are, how far and in what manner are these sciences to be introduced? Whatever is to be the amount taught, educators are agreed that the first steps in natural science, or, in other words, in systematizing natural knowledge, are to be taken as early as possible. Early impressions are the deepest, and every child before its school days is already an untrained student of nature. The foundations of technical education should, therefore, be laid in the primary school; but whether commenced thus early or not, the method will always be the same. The child must be encouraged and guided in its natural habits of observing, and it must be led to systematize its observations, connecting them together by a chain of reasoning into groups of related ideas. This method is simply that known as "object teaching;" and you may as well try to fly without wings, or to teach geography without maps or globes, as to teach natural science without objects and diagrams. There is not a teacher, now-a-days, but has heard of this object teaching; there are hundreds who have tried to utilize it; there are "colleges" in which it is professedly taught as a system; and yet there seems to be no method applied to the inculcation of natural science more misunderstood than this, and no teaching in our schools, at present, more utterly destitute of good results. Ninety-nine out of a hundred who talk so glibly of object teaching, forget that it is merely a method—a method that has for its end to inculcate knowledge; that this knowledge to be inculcated is the essential part of the lesson; and that a *thorough acquaintance with the subject must precede any application of this mere method of instruction.* To stand up and give a lesson upon a cat, without knowing the first principles of natural history, is simply to go through a farcical parody; and authorities who have no better conception of the purposes of object teaching than this, set the cart before the horse; or, rather, they never hitch on their should-be-useful animal at all, but ride off upon this hobby, leaving the load of knowledge it was meant to draw standing in the ruts—where it has been standing, as Professor Huxley admirably puts it, ever since the days of ancient Rome.

It has been recently advocated that every public school should be supplied with a collection of objects to illustrate the fundamental facts of natural science. By all means let it be so; but let the first use to which these are put be to instruct the teachers themselves in what they will have to teach. Let them learn what there is in each object of educational value, and what are its worthless characters; let them recognize that no object is complete in itself, but is merely a part of a vast whole, and that their office is to lead the child to recognize its most important relations to other objects. In building up the edifice of knowledge, they must not use every rough stone indiscriminately, but they must teach the little builders to chip off the useless angles of selected pieces, and so shape them that every stone shall, at its proper time, fit into its proper place. If this be not done, the most instructive objects in the world will not raise a single line of substantial structure, but will rest upon the minds of the pupils as an unarranged heap of meaningless facts—facts which will not even be long remembered; and it is as well that they should not be, because utterly useless, being unconsolidated by any cement of reason.

We fear that no better end is attained by, or can be hoped for from, object teaching in our public schools, until, as we have said, the teachers themselves are thoroughly educated in the principles of natural science. To accomplish this, however, the ear of those who rule the teachers must be gained; and we raise the question whether the representatives of science should not have a voice in the management of our public school system? As object teaching is a mere handmaid of science, is of use only to give scientific habits of thought, and to convey a knowledge of scientific facts, and is worthless without science, the public should see that

its introduction into our schools be carried on under the advice of scientific experts, who shall direct what is best to be taught, and advise with the adepts in teaching how such knowledge may best be imparted. As a journal having the interests of science and education at heart, desiring to see science soundly popularized, and the masses made acquainted with its technical value, we make this suggestion, and furthermore ask: Is there any man of scientific attainments in the present Board of Education? Is there any scientific authority upon its general staff? And how many teachers favorably known to and having the confidence of the really scientific portion of the community are engaged in giving scientific instruction in our public schools?

## SOCIAL SCIENCE.

Science, in the philosophical meaning of the term, is a collection of the general principles and facts relating to a subject, arranged in a systematic form. We do not, however, consent to apply this term to a collection of facts and deductions until the accumulation comprises the leading facts possible to be collected by the application of proper scientific methods. One would only be laughed at for styling ancient alchemy a science, though it was the beginning of one of the noblest of modern sciences. Facts, to become the proper basis of science, must be examined with careful scrutiny to exclude all which is only *seeming* fact, and to be sure that nothing creeps into the category incapable of demonstration.

A series of assumptions may form the basis of a beautiful system, but it is now universally agreed that assumptions are inadmissible where experimental knowledge is attainable. But experimental *knowledge* is only attained by well-conducted, accurate experiment. When a lad, the writer performed a series of experiments with some heterogeneous chemicals, culled from a quantity of old jars and bottles, without labels. He gained only the knowledge that such crude experiments are very dangerous, and gained it at the expense of a burned face and some other personal damage. Doubtless many interesting and important facts might have been demonstrated by the proper use of the substances referred to; but, in the hands of the inexperienced and unskillful, they were only capable of jeopardizing life and limb.

The history of the human race is spotted all along with results of just such crude experiments. At present, we are trying numerous social experiments on a grand scale. An explosion has just occurred in Europe which has cost two countries great bloodshed and misery. We ourselves recently came near to destruction by an explosion, the wounds of which will not be healed in half a century, and our experiment is not yet ended, nor by any means free from the liability of future disaster.

Looking over the history of mankind one may well ask, where are the carefully ascertained facts on which to build social science? Who were the master hands whose efforts demonstrated these facts to the world? If social science, properly so called, is a future possibility, is it, from the nature of the case, a *present* possibility? And are the so-called systems, for which their authors claim the proud name of "science," really worthy of the name?

In looking over a volume which has lately found its way to our table, and which purports, to be a treatise on Social Science,* we find much which gives a negative answer to the questions we have propounded. We find a negative answer, also, in the proceedings of so-called "Social Science Associations," and conventions, which contain little but disjointed theorizing upon assumed facts. We find a negative in the *status* of modern society in which suffering and misery are predominant, and much of which results directly from social organization. Mr. Carey, whose larger work—somewhat clumsily (we think) condensed by a female writer—forms the substance of the treatise under review, has acquired considerable reputation as a strong and fearless defender of the system of protection to American industry, and as a writer on political economy. His work entitled the "Past, Present, and Future" entitles him, in the opinion of the editor of the volume under review, to be called the "Newton of Social Science,"—a proud title, indeed, were it fitly applied. A comparison, however, between the labors of the two men, so far as Mr. Carey's socialistic speculations are concerned, will show, that where one took his points of departure from experimentally demonstrated and carefully ascertained facts, the other has made his deductions from the crude facts, the results of the turmoil of the jumbled elements of human society, as they have rushed together under the guidance of no directing mind.

Nor is Mr. Carey, in our opinion, free from the charge of building symmetrical theories, and regarding them as resting upon solid foundations, simply because their exterior presents a harmonious and firm appearance. Certain it is that his views have been strongly opposed by those who would have been convinced, had his system approached the demonstrative character of a science.

On page 27 of the work under review, we find the following paragraph:

"Seeking now to understand the history of man in past ages, or in distant lands, we must commence by studying him in the present; and having mastered him in the past and present, we may then be enabled to predict the future. To do this, it is required that we do with society as does the chemist with the piece of granite—resolving it into its several parts, and studying each part separately, ascertaining how it would act were it left to itself, and comparing what *would be* its independent action with what we *see to be* its societary action; and then, by help of the same law of which the mathematician, the physicist, the chemist, and the physiologist avail themselves—that of the composition of forces—we may arrive at the law of the effect."

Now, we ask, how we are to ascertain what the "parts" would do when left to themselves? Have they ever been so left, or, if they have, has their action been studied by those competent to study, and recorded by those competent to record? Does history show us any record of man except in some sort of social organization, possessing in itself the evidence of its unscientific structure? Surely, then, the action of the "parts" isolated must be assumed, unless we are to isolate them and experiment with them, as we do with the components of granite. No chemist ventures to predict what will be the properties of the components of a substance. He first separates the elements and applies to them rigid tests, to gain the knowledge he seeks.

Those who seek to frame a social science are in a position precisely similar to that of a man who should seek, by the aid of a book of ancient alchemy and a collection of animal, vegetable, and mineral substances, to create a science of chemistry. History teems with lies. To sift its truth from its falsehood puzzles the profoundest minds. It is plain that it is not a reliable guide in the construction of a system to which the name of science can be appropriately applied. All the experiments in social organization, even approximating to the rigid conditions which make experiment of any value, are found in social organizations like the Oneida Communists, and others of a somewhat similar character, and these are so few, and are accompanied by such palpable errors, as to exclude them from the pale of scientific investigation. Where, then, are the data? From what are the general principles to be evolved on which to build a science? In all attempts of the kind we have met, the principles are assumed, and the facts culled from the imperfect records of the crude experiments in association found in history. The book before us is not an exception, and though it is written in a vigorous style, and embodies much thought which is suggestive and instructive, we see nothing which entitles it to the name selected for it.

We have before avowed the belief that at present, at least, social science is not possible, and have entertained the doubt that the future will ever bring about a state wherein the elementary principles and facts necessary for such science will be obtainable. We may be in error in this opinion, but if so we are not alone in our mistake. We do not, however, on this account, deprecate the study of social organization, or political economy. We only wish to caution the student against mistaking assumptions for facts, and mere theories for the enunciation of principles.

* Manual of Social Science. Being a Condensation of the "Principles of Social Science" of H. C. Carey, by Kate McKean. Philadelphia: Henry Carey Baird, 406 Walnut street.

## THE FAILURE OF THE HON. OAKES AMES.

The recent failure of the Hon. Oakes Ames has made quite a stir in business circles. An instructive moral may be drawn from it.

According to the Springfield *Republican*, the legitimate business of Mr. Ames and his brothers was never in a more prosperous condition than at the time of the failure. The profits of their shovel factory is estimated at $1,000 per day, and the Ames Plow Company's business was also going on profitably and smoothly. The journal quoted says:

With the success of his first investments in railroad building in Iowa and in the Union Pacific Railroad, and the great power which such vast enterprises brought back to him, there grew up in Mr. Oakes Ames a real passion for gigantic operations among the material forces of our civilization. It came to be so strong that, as he once confessed, he could not resist the fascination of a brilliant opening for connecting States or cementing continents with railroads, founding a city, or reconstructing social order, with great money gains behind it. He had still on hand large railroad operations in Iowa and in the South; the Mobile and Chattanooga Road was under his patronage; he was a prime party in an organization for reviving and completing a new railroad from the Potomac across Virginia to the Ohio River; and his real estate investments were numerous and large in all parts of the country. The consequence was, of course, an ever-increasing mountain of debt. Every new scheme locked up more and more means; they gave him great values—a wealth of lands, bonds, and stocks—but from which he could not realize at present; and so he came to be a borrower for millions, and needing, for fresh investment and to renew falling notes, new loans of $50,000 to $100,000 daily. Naturally, lenders became distrustful, and he had to pay higher interest. He found it more and more difficult and expensive to borrow, and only some untoward circumstance has been wanting for many months to close the market against him. This came doubly in the suspension of Mr. Treadwell, of San Francisco, the great dealer of the Pacific coast in agricultural implements, owing the Ameses, as reported, hundreds of thousands of dollars, and in the decision of Mr. Boutwell and the Attorney-General, backed by public opinion, against the impudent demand of the Union Pacific managers, that the Government should put its bonds and their interest back of their own income and land-grant bonds and stock—in effect, to surrender the Government claim to them entirely—which impaired the market for all Union Pacific securities, of which Mr. Ames is still naturally a very large holder.

Now, in these facts is contained a lesson well worth pondering. The greed with which men seek to amass colossal fortunes, and the impatience of delay in the realization of their ambitious schemes, are characteristics of American business men, which have become vices. The old avenues of trade by which their fathers secured fortunes, and were able to keep them when obtained, are too slow for the average American of to-day. Gigantic risks are unhesitatingly assumed if they offer a chance of rapid accumulation. The spirit of speculation has possessed the commercial public, and men stop at no means, within the limits of the law, to hasten their progress towards wealth.

Hence we have the spectacle of men like the Hon. Oakes Ames unblushingly casting their votes in our legislative bodies for measures which indirectly aggrandize themselves, and which have no other purpose. The interests of the commonwealth, duty to constituencies, official honor, all are forgotten in the mad scramble for wealth, and the power which wealth brings.

Is it to be wondered at, that in all this scramble and haste, men should frequently stumble and fall? Is it a wonder that confidence falters, and that men hesitate whom to trust? Is it a wonder that large monopolies are created; that the big fish eat the little ones, and that public and private morals deteriorate?

Did this affect only the personal interests of the men who thus seek to build their own fortunes at the expense of others, it would not be a matter of so great import, but when men like Oakes Ames fail, the industrial interests of the entire country suffer; credit is damaged, and general embarrassment is created.

We wish we could see a prospect of a more moderate ambition, and a return to the slower, but surer, paths to wealth in the immediate future; but in all the signs of the times we read no such pleasing augury. We must wait, therefore, till wisdom is obtained in the school of disastrous experience, and misfortune has cured the mania for rapid money-getting, now unfortunately so prevalent.

## RAILROAD PROGRESS IN THE SOUTHERN STATES.

In no one particular has the South so materially advanced as in the construction of new railroad lines. Perhaps she has thus advanced more in what she proposes to do and is doing than in what she has done. With many navigable streams flowing through their land, and the slow character of business dealings previous to the war, the people of the South did not so much feel the necessity of well-conducted railroads as in these days of rapid transportation and quickly-made fortunes. Hence, many of the railroads built and existing in the South previous to 1861 were poor affairs, and in many instances more progress has been made in improving the old than in constructing new lines. Instances there are, too, of tracks torn up in the military operations of the war, which, like their owners, have been reconstructed, much to their present benefit and future durability.

In 1864 there were 8,944 miles of railroads in the Southern States proper. Of these 296 miles were built during the war, viz.: in North Carolina, 47 miles; Tennessee, 43 miles; Alabama, 62, and Texas, 144 miles. Up to 1871 there have been built 1,461 miles of railroad. These figures are according to "Poor's Railroad Manual," which, however, takes no note of the fact, that to build the forty-seven miles in North Carolina, another railroad was torn up by the Southerners. In Virginia there have been 104 miles of new railroad built. This work is chiefly on the Chesapeake and Ohio road and the road from Richmond to York River; also some on the Alexandria, Loudon, and Hampshire road. A great deal has been done in renewing and rebuilding old lines. The amount of this last character of work is particularly noticeable on the lines controlled by General Mahone, from Norfolk to Bristol, Tenn.

Of new roads, and roads in progress, the Chesapeake and Ohio, which has so slowly dragged its weary length along, commands first attention. It is intended to be a great through line for grain and other freight from the Ohio River to tide water at Richmond or below. It is being built as fast as the nature of the country will admit. The contract stipulates that it shall be finished in running order by January 1, 1872. The entire length is 427 miles.

Another line of great importance is one proposed to run the entire length of the famous Shenandoah Valley to Salem. It has been placed under contract, but will be built slowly, unless taken in hand by the Baltimore and Ohio Railroad Co., which line it would benefit. Another line much talked of, but hardly to be built, is an air line west from Norfolk to Bristol, Tenn., partly in North Carolina and partly in Virginia.

In North Carolina, there have been built 146 miles of new railroad, being on the Western North Carolina, Wilmington, Charlotte and Rutherford, and Williamston and Tarboro roads. The first pierces the Blue Ridge, and is to open up the fertile and beautiful mountain section of the State. Of roads in progress, the extension of the Western North Carolina down the French Broad, thus to connect with the East Tennessee Railroad, has been graded. A portion has also been graded of the Western Division of the same road to run directly west to the Georgia line, and there to connect at Dalton, Ga. The Wilmington, Charlotte and Rutherford Railroad is slowly progressing from Wilmington to Charlotte. The Chatham road has been built from Raleigh southwards thirty-one miles, and is to be extended to South Carolina. The Fayetteville and Coalfields Railroad is chartered to extend to Salisbury, but there is no work being done on it, and but little, in fact, on any of these routes. Lines are proposed from and to various points, but none of them are likely to be built in the present condition of the State finances. But little of the track in this State was torn up during the war; but many bridges burned have been rebuilt, and a new one of great strength and handsome architecture constructed across the Cape Fear, at Wilmington.

In South Carolina 128 miles of road have been built, being the air-line from Columbia to Augusta, and part of the road from Augusta to Port Royal. This latter road is to be finished in 1871. The Blue Ridge road, intended to cross the southwestern end of North Carolina to Knoxville, Tenn., has not progressed any since the war. The contract was at one time let out, but afterwards abandoned.

In Georgia 232 miles have been built, being chiefly the Macon and Brunswick road, and the completion of the Selma, Rome, and Dalton, from the Alabama line to the latter point. In progress the Brunswick, Albany, and Eufaula road is most

prominent, as by its connection in Alabama, it is destined to form eventually a great freight line. Several small lines have been built within the past year, shortening the distance from Macon to Augusta. The Cartersville and Van Wert road, a short line, but one of much local importance, will be completed in a few months. The Atlantic and Gulf road also expects to run a branch north to Columbus during 1871. While Georgia can lay claim to having one of the best railroads in the South, she is disgraced, too, by, without doubt, the meanest. The Muscogee road is a shame to any people, and especially so to a corporation that is able to do better.

In Florida only 44 miles have been built, being the extension of the Florida Central from Lake City west. A number of roads are projected, and bonds appropriated to build them, but none are likely to be finished at present. A line is projected north and south through the State to some point on the mainland near Key West.

In Alabama the greatest progress has been made, there having been built 276 miles of road, and there is, at least, as much more in progress. The miles constructed are chiefly on roads in progress, the only completed line being the Selma and Montgomery. The Alabama and Chattanooga Company are rapidly completing their line. The North and South R. R., a line of much importance, is nearly completed. From Selma to Memphis the road is being rapidly built, as is also the Selma and Mobile. The Eufaula and Selma has been in great part graded, and some parts laid with iron. The Savannah and Memphis, from Opelika to Decatur, has been laid with iron about 30 miles, and is under contract the rest of the route. Many of these roads are intended to assist in developing the great mineral interests of the State. There have been some improvements in the old railroads of the State, not, however, so much as in Georgia, and in this respect the Selma, Rome, and Dalton is the only one which can lay any claim to being first-class.

In Mississippi 128 miles have been built, being a portion of the Selma and Memphis, and the New Orleans and Mobile; also a few miles of the Alabama and Chattanooga. The old railroads of the State have been somewhat improved, especially the N. O., Jackson, and Great Northern. The principal proposed railroad of this State is a continuation of the latter line from Canton to Decatur, Ala.

In Louisiana forty miles have been constructed, being chiefly the Southern Pacific line from Vicksburg to Shreveport. Several lines are proposed in this State, all looking to connection with Texas. The one just alluded to is being rapidly completed.

The Alabama and Chattanooga Co., are said to be endeavoring to control all avenues to the Southern Pacific R. R., by buying up old lines and building new. In this they have rivals from St. Louis and Memphis on the north and New Orleans on the south. One of their own lines, also, starts from New Orleans. The rivalry cannot but be of benefit to the people and the country.

In Tennessee 155 miles have been built, chiefly short branch lines or spasmodic efforts towards commencing great trunk lines, as the building of 30 or more miles on the Cincinnati, Cumberland Gap, and Charleston R. R., and a like number on the Blue Ridge, etc. All the railroads in which the State is interested are to be sold; they will undoubtedly fall into Northern hands and then be completed.

In Arkansas 90 miles have been built, being the line called Memphis, El Paso, and Pacific, from Memphis west. Another line from Memphis to St. Louis, running up the river in this State, is in progress. Lines are also in progress from St. Louis to the western part of the State and through the Indian Territory.

In Texas 132 miles have been built, being parts of various roads. The future of this State in the railroad line is certain to be great. The character of the country enables them to be built cheaply, the State grants public lands to them, and the fertile soil attracts emigrants, who demand this character of progress. The Southern Pacific skirts its northern border and a half dozen lines shoot up from the south to connect with it, while transversely, others are being constructed or planned.

Such is a brief sketch of the railroad progress of the South. That the next ten years will show a still greater progress, there is no doubt. A point of note in all these new lines is, that they are being completed with the latest improvements. Steel rails are not required, but the fish-bar joint and continous rail tell of comfort, in the future, for those traveling South. The first completed line of road over which mails and passengers were carried, was in the South, yet since that she has lagged far behind. It is frequently thus that pioneers are outstripped in the race of progress by those who adopt their ideas, and there is every probability that we shall be able to show England the best railroad, as we have already the best locomotive. Thus, too, the South has had to learn from the North the perfection of steamship and railway transportation, both in freight and passengers, although she first inaugurated them in this country.

### New Use of Dolomite.

We are all of us familiar with the lime light produced by the heat of the oxyhydrogen jet impinging upon a pencil of lime. It now appears that a prism cut out of the mineral dolomite will emit a light as powerful if not superior to the calcium light. The dolomite is made up of nearly equal parts of the carbonate of lime and magnesia, and the combination of these two earths produces effects superior to what can be obtained from either of them alone. The light is said to be suited for photographic purposes, especially for copying pictures. As dolomite is an abundant rock, its application for purposes of light may prove of peculiar value.

### ON BLOOD AND ITS USES.

Blood is the liquid which circulates in the arteries and veins of animals. It is made up of colorless substances dissolved in water, and of red undissolved particles diffused through the liquid. It has a saline taste peculiar to the animal from which it is drawn, and modern microscopic research has shown that it is possible to distinguish not only the species of animal from which the blood is taken, but also from what function of the body it was derived.

When fresh drawn it rapidly coagulates into a gelatinous mass called clot, from which a pale yellow fluid separates known as serum. The clotting can be in a measure prevented by agitating the blood with a bundle of twigs or metallic rods. We do not propose to speak of blood in the animal economy, but of its employment in the arts.

SAUSAGES.

Blood has long been employed in some parts of Germany in the manufacture of sausages, known as blood sausages. The peasants stir it thoroughly, just as it is drawn, so as to prevent the formation of clot, and afterwards mix it with the hacked meat. The sausage is not particularly toothsome to strangers, but the natives take to it very kindly.

CLARIFYING SIRUP.

For the purpose of clarifying sugar-sirup blood has long been employed, but this has ever been, as it always must be, regarded as a repulsive method for the purification of an article of diet. The principle upon which it works is the coagulation of the blood by heat, thus carrying with it the coloring matter and impurities. Where albumen can be introduced as a substitute it is found to be preferable on many accounts. The nauseous and sickening odor that comes out of the purifiers when a new charge of blood is introduced, fills half the sugar refinery, and renders the place nearly uninhabitable for several hours. It is not to be wondered at, therefore, that persons engaged in the sugar trade have tried to find a less offensive substitute. For their use, and for analogous purposes, attempts have been made to manufacture albumen from blood with very encouraging results, as we shall see further on.

ARTIFICIAL WOOD.

Artificial wood has been for some time prepared in France by compressing sawdust and blood albumen at a suitable temperature into a solid mass, suitable for cabinet work, decoration for clocks, and interior ornamentation. It is claimed that this wood is more durable than the natural growth. Shavings and sawdust are ground to a powder, and mixed with blood sufficiently diluted with water, and dried at 106° to 120° Fah., in a suitable oven. The albumen of the blood thus becomes intimately incorporated with the sawdust, and the prepared wood in the form of fine powder is put into molds, where it is subjected to a powerful pressure with a hydraulic press. The plates of the press are heated with gas sufficiently to reduce the contents of the molds to a semi-fluid mass.

Resinous woods are found to combine better with the albumen than hard woods. The artificial wood can be cut and worked in the same manner as lumber, and as it is made chiefly of refuse material, the price in France is such as to render it available for many purposes. The ground wood, after being saturated with blood albumen, has the specific gravity of 0·800, but after having been subjected to the hydraulic press it is 1·300.

MANUFACTURE OF PRUSSIAN BLUE.

Attempts have been made to employ blood in the manufacture of ferro-cyanide of potassium. 150 pounds of well-dried blood were melted with 100 pounds potash, but it was found that no more than one sixth of the nitrogen was economized. The yield ought to have been 127·5 pounds, instead of which only 19·7 pounds were obtained. It would appear from this experiment that Prussian blue cannot be economically made from blood.

MANUFACTURE OF ALBUMEN FROM BLOOD.

In Pesth, Hungary, blood is dried in about twenty-four hours, at 100° to 112° Fah., in flat iron pans; and it has been found in practice that 110 pounds of albumen can be made from 3,000 pounds of blood. The best quality is clear, transparent, and soluble in cold water, and is used for mordanting goods. It costs in Pesth 60 florins for 110 pounds, whereas it would require 16,200 eggs to make 110 pounds albumen, the cost of which would be 200 florins. The egg albumen is more expensive, but is preferred for most purposes. The second quality of blood albumen is darker in color, but is nearly all of it soluble in water, and is used by sugar refiners. It can be kept any length of time without change, is effective in small quantities, and is quite uniform in its action, so that it can be used by sugar refiners with great economy.

A more complicated process for the manufacture of blood albumen is pursued in Northern Germany. The blood is caught in round zinc pans, three inches deep, and is put aside in a quiet place until it is coagulated. Only a small part of the serum separates on the top. The coagulated blood cake is cut into small cubes, and thrown upon seives or strainers, and the serum, mixed with blood corpuscles, flows off into pans provided with movable tubes, so that at the proper moment it can be drawn off without carrying the impurities with it that may have settled on the bottom. The serum obtained in this way is run into square porcelain dishes, and exposed to a current of air at 50° to 60° Fah., and is thus rapidly dried. It is indispensable to have the blood in thin layers to avoid its decomposition from moisture.

Richter finds that the blood of buffalo yields a whiter serum than that of other animals. It may be well in this connection to remark that albumen from fish has been made of good quality, and at a fair price.

Some varieties of blood albumen have been found on analysis to contain 53 to 55 per cent of soluble albumen, and in this state of purity it can be advantageously employed in

CALICO PRINTING.

In order to fix aniline colors, it is necessary to use albumen, and as these colors are now very popular, the consumption of eggs for furnishing the requisite quantity of albumen has become enormous, and the price of albumen is raised in proportion. We understand that the use of blood albumen by the calico printer is very large at the present time, and is constantly increasing; and that it can successfully compete with the egg albumen.

IN PHOTOGRAPHY.

Albumen paper has become very popular in photography, and some of our large manufacturers of photographic material use many gross of eggs in the preparation of the paper. If the blood albumen could be made sufficiently white and pure to be used as a substitute for the albumen of eggs, it would be a great boon to artists.

IN AGRICULTURE.

Blood is a powerful manure, and has long been used for this purpose. It is also employed in making cements, in mixing with coarse pigments for protecting walls from the action of the weather, in making animal charcoal, and as a coloring matter.

The above are some of the uses to which blood is applied in the arts.

### Frendeet.

Sir S. W. Baker, the famous African explorer, states in his exploration of the Nile tributaries, that he was often called upon, in his capacity of physician, to treat diseases among the natives; but there was one complaint that baffled all his skill, and he was obliged to leave it entirely to the Arabs. It is caused by drinking water from table land pools. Frendeet commences with a swelling of one of the limbs, with intense pain; this is caused by a worm, several feet in length, but no thicker than a packthread. The Arab cure is to plaster the limb with cow dung, then prick the skin in many places with a red hot lance, to form doors, as they term them, for the escape of the worm. In about a week one of the wounds formed by the lance will inflame like a boil, and from it the head of the worm will issue, when it is seized and fastened to a small piece of wood, and gently wound daily, until, in the course of a week, the entire worm will be extracted, unless broken during the operation, in which case severe inflammation results.

## Queries.

[*We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers, and hope to be able to make this column of inquiries and answers a popular and useful feature of the paper.*]

1.—LEAKY CISTERNS.—What is the best method of stopping leaks in a wooden cistern? Is there any cement that will adhere to the wood, and which can be used for this purpose?—L. B.

2.—What is the best solder for aluminum? Is there not a better recipe than the following? Aluminum, 15 parts; tin, three parts bismuth, one part. This will do, but I wish to obtain a solder which will not change in the mouth when used for dental purposes.

3.—TURNING LATHE.—There is a lathe in the shop I work in, that no man in the shop can turn a true cylinder on, when the centers are straight. What is the trouble? I have worked on this lathe, and find that the centers being set straight, the cylinder will be one sixty fourth of an inch larger at the tail stock than at the cone. We get along by setting the tail stock over, as though we were going to turn a taper. What I wish to know is, why the lathe will not turn a true cylinder when the centers are straight, everything else about the lathe being in place? There are several machinists in the shop; all have tried to find the trouble and failed.—M C. B.

4.—GALVANIZING STEEL SPRINGS.—How can I galvanize steel springs without injuring the temper?—W. G. B.

5.—How can I fasten sheet copper to rough or smooth cast iron without rivets or bolts?—J. W. B.

6.—I wish a recipe for a leather cement, such as is used by belt manufacturers.—B. B. G.

7.—BROWNING GUN BARRELS.—Will some practical man tell me how the fine clouded brown on the fine double guns of the present day is produced, with full details of the process?—E. H. B.

8.—STEAM PUMP FOR HIGH PRESSURE ENGINE.—I am concerned in a steam tug. The cylinder is 16x16, and, as usual with small high-pressure engines, the pump, which is ample, is not the least troublesome item. Our first engineer inserted a waste pipe in the air chamber, and by means of a stop-cock let off, at each stroke, so much of the pumped water as he did not want in the boiler. The next man made use of the "sea cock" to throttle back so much of the water that the pump required as he did not want in the boiler. I object to both methods as unengineer-like, and propose to govern the quantity injected by making the stroke variable. Will your engineer correspondents please give an opinion on each of the modes, and say what way is generally adopted or considered best?—P. D.

9.—TOUGHENING BRITTLE HORN.—How can horn that has become brittle by age become tough again?—B. A. C.

10.—How can I tan or cure sheep's pelts with the wool on so that the skin may be soft and pliable, and the wool uninjured?—B. F. P.

11.—BRASS CHAIN.—How can I make a solder to braze brass wire rings? I want to make brass chain, and have the solder dip yellow, the same as the brass wire. I have tried silver solder, but that turns black on dipping in acid. I want the solder to melt at a low heat, that is, about the same as silver solder, cherry red.—G. H. H.

12.—BOILER FIRING.—How can I fire up my boiler so as to keep up seventy pounds pressure? The boiler is 8½ feet long and 42 inches in diameter. It is used for a tannery. I can run all my other machinery, but when I grind bark I cannot keep up pressure; must stop twice per hour to raise steam, even with all the other machinery detached. I commence grinding with seventy pounds and run down to sixteen pounds. The boiler is an upright one, and I use the best of wood for fuel when grinding. The smoke stack is red hot six feet above the boiler. The size of the engine is 8x24 inches. When running, every time I fire up I lose five pounds of steam. I feed hot water, and have a good draft, and would like to know if I could not save the heat passing through the stack and use it for the boiler. The engine runs sixty-five revolutions per minute.—M. S. M.

# New Patent Law of 1870.

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### NEW BOOKS AND PUBLICATIONS.

A TREATISE ON THE THEORY AND PRACTICE OF LEVELING Showing its Application to purposes of Railway Engineering and the Construction of Roads, etc. By Frederick W. Simms, F.G.S., M. Instit. C. E., Civil Engineer. Fifth Edition. Revised and Corrected, with the Addition of Mr. Law's Practical Examples for Setting out Railway Curves. With Three Lithographic Plates and several Wood-cuts. New York: D. Van Nostrand, Publisher, No. 23 Murray street and 27 Warren street.

This being a new edition of a well-known valuable work it would be unnecessary here as well as impossible in our limited space to give it an extended review. It is enough to say to those who are not acquainted with the merits of the work, that it is one of the best treatises on the subject of leveling extant. The addition of the practical examples mentioned in the title will prove a great help to students, and even to those who have passed the student stage and have become engaged in the actual practice of engineering. The book is printed in fine bold type, is well bound, and presents a handsome appearance.

THE PHRENOLOGICAL JOURNAL AND PACKARD'S MONTHLY. A Repository of Science, Literature, and General Intelligence. Embellished with numerous Portraits from Life, and other Engravings. Vol. L., Old Series; Vol. I., New Series, January to June, 1870. S. R. Wells, Editor and Publisher, No. 389 Broadway, New York.

Mr. Wells will please accept our thanks for a handsomely bound volume of this popular publication.

THE TECHNOLOGIST, for December, contains a fine table of contents. It closes the volume of this well-conducted and interesting monthly. It is issued by the Industrial Publication Company, 176 Broadway, New York, at the low price of $2·00 per annum.

WE are in receipt, by the courtesy of the Hon. Horace Capron, U. S. Commissioner of Agriculture, of his Report for the year 1869. It is a voluminous and instructive document. Mr. Capron will please accept our thanks.

## Business and Personal

*The Charge for Insertion under this head is One Dollar a Line. If the Notice exceed Four Lines, One Dollar and a Half per Line will be charged.*


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Situation Wanted by a Practical Draftsman. Best references given. C. Collins, 33 Nassau st., Newark N. J.

Grindstone Shafts, by J. E. Mitchell, Philadelphia, Pa.

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"How to use Grindstones," by J. E. Mitchell, Philadelphia, Pa.

At the Cincinnati Industrial Exposition, Oct., 1870, the judges say: "The Union Stone Company exhibit Emery Wheels and Grinding Stones which are composed of materials not affected by water, and that do not glaze in doing ordinary work, and do not produce a disagreeable smell when doing hard work. We consider them the best article of the kind on exhibition.

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Improved Foot Lathes. Many a reader of this paper has one of them. Selling in all parts of the country, Canada, Europe, etc. Catalogue free. N. H. Baldwin, Laconia, N. H.

Peck's Patent Drop Press. For circulars address the sole manufacturers, Milo, Peck & Co., New Haven, Ct.

Peteler Portable R.R. Co., contractors, graders. See adv'ment.

Dickinson's Patent Shaped Diamond Carbon Points and Adjustable Holder for dressing emery wheels, grindstones, etc. See Scientific American, July 24 and Nov. 20, 1869. 64 Nassau st., New York.

E. Howard & Co., 15 Maiden Lane, New York, and 114 Tremont st., Boston, make the best Stem-winding Watch in the country. Ask for it at all the dealers.

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Scale.—Allen's Patent will remove scale from steam boilers, and not injure the iron. Send for Circulars. Josiah J. Allen, Philadelphia.

Building Felt (no tar) for inside and out. C. J. Fay, Camden, N.J.

Patent Elliptic-geared Punches and Shears.—The greatest economy of power, space, and labor. Can be seen in operation at our factory, in Trenton, N. J. Address American Saw Co., 1 Ferry st., New York.

Hand Screw Punches and Lever Punches. American Saw Co., New York.

Steel Stamp Alphabets, Figures, and Names. E. H. Payn, Burlington, Vt.

Self-testing Steam Gage—Will tell you if it is tampered with, or out of order. The only reliable gage. Send for circular. E. H. Ashcroft, Boston, Mass.

Glynn's Anti-Incrustator for Steam Boilers—The only reliable preventive. No foaming, and does not attack metals of boilers. Price 25 cents per lb. C. D. Fredricks, 587 Broadway, New York.

The Merriman Bolt Cutter—the best made. Send for circulars. Brown and Barnes, Fair Haven, Conn.

Manufacturers and Patentees.—Agencies for the Pacific Coast wanted by Nathan Joseph & Co., 619 Washington st., San Francisco, who are already acting for several firms in the United States and Europe, to whom they can give references.

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House Planning.—Geo. J. Colby, Waterbury, Vt., offers information of value to all in planning a House. Send him your address.

A very Valuable Patent for sale, the merits of which will be appreciated at sight. Apply to or address Jewell & Ehlen, 93 Liberty st., N.Y.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Belting that is Belting.—Always send for the Best Philadelphia Oak-Tanned, to C. W. Arny, Manufacturer, 301 Cherry st., Phil'a.

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## Answers to Correspondents.

*CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.*

*SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at 1·00 a line, under the head of "Business and Personal."*

*All reference to back numbers must be by volume and page.*

FILTERING WATER.—Your correspondent can make a cheap and good filter in his cistern by simply partitioning off one corner with one course in thickness of soft-burnt bricks, leaving a space inside of about 18x36 inches at the top of the cistern, making a close-fitting cover, through which to insert the pipe from the pump. The water will filter through the partition just about as fast as it comes into the outside cistern. F. A. H.

CLEANING FIRE-ENGINE BOILERS.—I think the trouble with H. C.'s Cole steam fire-engine boiler would disappear by the attachment and use of a surface blow-off. I find it so not only with such engines, but locomotives.—T. L. V. D., of Neb.

QUARTER TWIST BELT.—If it would not be too presumptuous in a young mechanic, I will give to J. F. K., and others if they wish it, a rule for putting on a quarter twist belt to make it stretch alike on both edges, and do their work well, no matter what the width of the belt. The belt is to be put on in the usual way, and the ends brought together ready for lacing. Then turn one piece the opposite side (or inside) out, and lace. The belt will run, it will be found, first one side out, and then the other and will draw alike on both sides.—W. H. K., of N. Y.

QUARTER TWIST BELT.—If Mr. J. F. K. will put up a short shaft parallel with, and running at the same speed as his driving shaft, with driving pulley the same size as the one in the driving shaft for quarter twist belt, and two pulleys on his driven shaft, and use two five-inch belts, he will find it much better than one wide belt.—W. S., of N. Y.

T. M. H., of Pa.—In the system of levers described in your query, if the power be constantly applied in a tangential line to the arc described, by the ends of the levers, the leverage will be the same on each lever; but if it be applied in the direction of either the chord or sine of the same arc the leverage will be greater on the longer lever. In estimating the power of levers, the direction in which the moving force is applied must never be disregarded.

T. H. R., of Kansas.—The holes broken out of the bottom of your lamp chimney admit air, which mixing with vapor from the oil used in your lamp forms an explosive compound, which, when sufficiently heated, makes the slight explosion described, and extinguishes the light.

C. H. R., of N. Y.—The electric light produced by the use of carbon points in connection with a galvanic battery is continuous. The flashes or sparks generated by friction in electric machines may also be made to succeed each other with such rapidity as to produce the effect of a continuous light, though, of course, only a succession of flashes in reality.

T. H. D., of ——.—All other things being equal, the longer the nose of a fire engine, the less will be the volume discharged, the less will be the velocity of discharge, and, as a matter of course, the less will be the throw. The diminution is wholly attributable to friction.

E. F. D., of Conn.—Very many recipes for black ink have been published in the SCIENTIFIC AMERICAN. You say you have found none that suits, but give no requirements, except that it shall be jet black at first, and always remain so. Arnold's Japan ink comes as near this requirement as any we know. We do not think the powder mentioned in our description of a new printer's ink, could be used to make a writing ink.

S. L. G. T., of N. H.—If we understand your query, the pipe nearest the ground would exact the least power for the supply of water to your city, for the two reasons, that being shorter it would have less friction, and the hight to which the water would be raised would also be less.

J. W. M., of N. Y.—There is no substance known that, placed between the poles of a magnet and its armature, will intercept the attracting power of the magnet.

W. H., of Wis.—The lubricating oil, called "West Virginia Black Oil," contains, we believe, some volatile hydrocarbons, which justify the discrimination made against it by the underwriters.

H. S. S., of Minn.—Rubber is not melted in the process of making overshoes as now conducted. The information you seek is hard to obtain, as the manufacturers refuse to disclose their processes.

S. A. R. and G. W. McK., of Ohio.—So far as we know, there has been no recent contest between English and American mowers and reapers.

H. E. S., of Kansas.—We know of no preparation that will remove hair from the human body without injury to the skin.

G. E. S., of Wis.—You should apply to some extensive dealer in paper hangings. Your query is not of sufficient general interest for publication.

A. L., of Texas.—Colored men have taken out patents, but as yet they, as a race, have not developed large inventive genius.

G. L. E., of Mass.—The tunnage of the *Great Eastern* is 27,000.

## Recent American and Foreign Patents.

*Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.*

COTTON-SEED PLANTER AND GUANO DISTRIBUTER.—Henry L. Tillery Halifax, N. C.—This invention relates to divers improvements in a machine intended for distributing guano in a drill, and then for planting cotton or other seed in the same drill, said improvements consisting of corrugated wings on the drum that sits within the seed-box, and of an arrangement of an A-shaped scraper, whereby the same may be made to cut furrows of greater or less depth; and of sundry other arrangements of said scraper and other devices.

"TARGET GAME."—John C. Schooley, New York city.—This invention relates to a target through which is made a dozen, more or less, of holes, each hole being marked with a certain number; and in combination with the target a ball connected therewith by an elastic cord, the object of the game being to send the ball through one of the holes in the target by the recoil of the cord after it has been stretched.

EXTENSION PLOWSHARE.—George W. Thorp, Columbus, Kansas.—This invention has for its object to furnish an improved plow, which shall be so constructed and arranged that the share may be extended as it becomes worn and held securely in place when adjusted.

CORN PLANTER.—Fielding W. Poe, Jr., Vandalia, Ill—This invention relates to certain improvements in corn planters, which appertain especially to the means whereby the seed-tubes are raised and lowered; and to the means whereby the seed-tubes are made to follow the inequalities of the ground; and to the means for insuring the "second drop."

SPARK ARRESTER.—Charles Pierpont, Durand, Wis.—This invention has or its object to furnish a simple and effective spark arrester for attachment to engine smoke-stacks.

FETTER OR CLOG FOR FOWLS.—Sanford J. Baker, Madison Center, Me.—This invention has for its object to furnish an improved fetter or clog for nens, turkeys, and other fowls, to prevent them from scratching in gardens, yards, fields, etc., which shall be simple in construction and effective in operation.

CORN PLANTER.—Joseph M. Whitmore and John N. Arvin, Valparaiso, Ind.—This invention has for its object to furnish an improved corn planter, which shall be simple in construction, easily operated, and effective in operation, and, at the same time, so constructed as not to be liable to get out of order.

SCREW-CUTTING DIES.—W. F. Cole, New York city.—This invention relates to improvements in screw-cutting dies with movable cutters, and has for its object to provide an arrangement, whereby the blocks may have the equisite strength and capacity, especially in the part for supporting the cutting ends of the cutters, with less metal used than heretofore.

RAILROAD CAR SPRING.—Albert Potts, Philadelphia, Pa.—This invention relates to a new manner of arranging, holding, and compressing the spiral springs for railroad cars, so that the same will be prevented from bulging out or bending when contracted, and increase in power of resistance with the weight.

FRAME FOR WHEELBARROW.—B. W. Tuthill, Oregon City, Oregon.—This invention relates to a new construction of metallic frames for wheelbarrows, and consists in making the two side bars or pieces of the frame together with the handles, all of one continuous piece of tubing. Great strength and simplicity of construction are thus obtained.

NAIL HEAD.—Thomas C. Richards, New York city.—This invention relates to a new arrangement of ornamental picture nail heads, with the object of facilitating the attachment of the same to the nails.

SEEDING MACHINE.—Jackson Cozad, Corydon, Iowa.—This invention relates to a new machine for scattering seed broadcast, and consists in the application and arrangement of a rotary basin, which serves by centrifugal force to throw the seed in all directions. The apparatus is applicable to all wheeled vehicles, and readily detachable when not required for use.

CAR-WHEEL MOLDS.—Wm. E. Worth, San Francisco, Cal.—This invention relates to improvements in rotary molds or flasks for utilizing the effect of centrifugal force to dispose the metal in casting car wheels. It consists in making the mold of a perforated disk of metal, and a ring fitted to it on which the chill ring rests, and the cope of a top plate and ring, all fitted together and to a disk on the top of a rotary shaft, for clamping together and to the disk, and the top and bottom plates are provided with ventilators.

CLOTHES PIN.—Geo. A. Harris, Buchanan, Mich.—This invention relates to improvements in clothes pins, and it consists in two pieces of wood or other substance, pivoted together at or near the center, and provided with an india-rubber spring between the pivot and one end, having a hole through it in the lengthwise direction of the said pieces, which are grooved, and the point is so formed that the clothes line may be passed through in the said direction, and the pieces will be clamped upon it at one end by the spring.

CLOTHES FRAME.—Henry M. Stevenson, South Peacham, Vt.—This invention relates to improvements in clothes-drying frames, and it consists in a frame composed of two side panels and two top panels, the side panels being jointed and braced, and connected to each other by jointed cross bars, the top panels being pivoted to the side panels at the top, one to each, and provided with pivoted braces for holding them in the oblique positions corresponding to the rafters of a house; all so arranged that the said dryer may be adjusted to one shape to stand in one position alone, or in other positions for leaning against a support, and may be folded together for stowing away.

REVERSIBLE PLOW.—G. W. Thompson, Ripley, Ohio.—This invention relates to improvements in reversible plows, and consists in making the double mold board of sheet metal in two parts, joined transversely at the center between the points where they are riveted to the oscillating brace connecting them with the plow beam. It also consists in an arrangement of the said brace calculated to prevent clogging.

SHOT CASE AND DISTRIBUTOR.—Sinclair Booton, Seguin, Texas.—This invention was fully illustrated and described in the last issue of the SCIENTIFIC AMERICAN.

DOUBLE HINGE.—John S. Jenness, Bangor, Me.—This invention relates to a new and useful improvement in hinges for hanging doors, more especially designed for trap doors, by means of which the door when open is made to rest flat upon the floor.

CLOTHES LINE HOLDER.—Ezra W. Talbott, Napoleon, Ohio.—This invention relates to a new and useful improvement in mode of raising, stretching, and holding clothes lines.

DROP-HAMMER LIFTER.—Francis M. Hodge, Shelburne Falls, Mass.—This invention relates to improvements in drop-hammer lifting apparatus, and consists in the application to the shaft of a drum, which lifts the hammer by winding up a belt attached to it, of an oscillating steam piston within a fixed case, and a tapped disk with lappets for shifting a steam valve for admitting the steam to the piston, and exhausting it; the object being to apply the steam directly to the shaft of the drum, so as to dispense with intermediate apparatus.

CALIPERS.—William P. Hopkins, Lawrence, Mass.—This invention relates to improvement in calipers, and in the adjusting nuts therefor, and consists in arranging the adjusting nut and screw (or screw only, when used without a nut) for spreading the legs apart, and to serve as a stop when they are forced together, and in arranging the spring to force the legs together, the object being to provide calipers which may be used for taking the gage of plates, disks, and the like, which are thicker at the rims than inside the same, by opening the legs to pass over the thick place, and adjusting the nut or screw to the right point, then opening the calipers to disengage them from the plate, after which the spring will close them down to the nut again, in the same position as before.

PAINT BRUSH.—William B. Burtnett, New York city.—This invention relates to improvements in the construction of paint brushes, and it consists in improvements in the construction of the conical plug by which the bristles are wedged into the ferrule, and the handle is secured in the ferrule, to facilitate the application of the plug and the tightening of the bristles. It also consists in the arrangement of the handle and the plug relatively thereto o facilitate tightening up the bristles in case they become loose by the age of the plug.

COMBINED GUIDE FOR SEWING MACHINES.—William H. White, Baltimore, Md.—The object of this invention is to combine in one simple, practicable instrument, devices which will fold, hem, and bind in many different ways, each of which has heretofore required a different guide, and to adapt such instrument at the same time to the manufacture of French folds, in two, three, or more parts.

SAW SET.—H. A Harris, Center, Texas.—This invention has for its object to furnish an improved saw set for setting the teeth of circular and other saws, which shall be simple in construction, convenient in use, and effective in operation, enabling the teeth to be all set at the same pitch and at any desired pitch.

SAWING MACHINE.—W. A. Allen, Baltimore, Md.—This invention relates to improvements in machines for splitting kindling wood, and it consists in a combination with a fixed feeding spout, of a pair of reciprocating splitting blades and a holding and discharging plate, in a manner to split the block into slabs, and the slabs into small pieces, and discharge the same after being split, in a simple and efficient manner. It also consists in an arrangement with the hopper of a gate for preventing the discharge of the wood in case he feeding is stopped while the machine continues to run.

ADJUSTABLE COFFEE AND TEAPOT STRAINER.—G. A. Barron, Pembroke, Maine.—This invention relates to a new and useful improvement in strainers for coffee and teapots, and consists in a cylinder, open at each end, composed in whole or in part of perforated metal or wire gauze, and constructed so as to be varied in diameter to fit tea and coffee pots of different sizes.

CHURN DASHER.—Robert Brown, Columbus, Miss.—This invention relates to improvements in churn dashers, and consists in a wide ring of metal with two sets of oblique bars traversing the space within the ring in a way to be very efficient in agitating the cream.

MANUFACTURE OF PILLS.—Pierre Cauhaepe, New York city.—This invention relates to improvements in the manufacture of pills, and it consists in the employment, either in combination with a molding device for shaping the pills or other holder for them, of a comb bar with pins or needles adapted for inserting a pin in each mold cavity for taking the pills and dipping them in the coating solution, and a clamp and stripper for taking them from the needles and redipping them for filling and covering the cavities formed by the pins.

BASIN COCK.—C. A. Newton, Providence, R. I.—This invention relate to improvements in wash-basin cocks, designed for drawing hot or cold water from one cock, and consists in a combination with a vertical tube having two independent passages and adapted for attachment to the table in which the basin is placed, and a nozzle fitted to it to cut off one passage, while allowing the water to discharge from the other, of a branch attachment and packing therefor of peculiar construction for the attachment of the hot and cold water pipes.

MOTIVE POWER.—C. A. Mills, Bridgeport, Conn.—This invention relates to improvements in motive power, and it consists in a combination with a wheel having buckets, and mounted to work in a vertical plane, of a couple of chambers for holding and delivering sand, shot, or other like matters to be used to apply the power by flowing upon the wheel, said chambers being supported on opposite sides of the wheel by a case disclosing the wheel and serving to conduct the flowing matter from the wheel into the chambers, which case may be turned by hand or other means to shift the loaded chamber from below to the top, and the empty one from top to bottom, when the flowing matter has run through.

## Inventions Patented in England by Americans.

[Compiled rom the Commissioners of Patents' Journal.]

PROVISIONAL PROTECTION FOR SIX MONTHS.

SEWING MACHINE.—David Whittemore, Boston, Mass. December 3, 1870.

AXLES AND AXLE-BOXES FOR WHEELED VEHICLES.—Ernest Von Jeinsen and James Monroe McDonald, San Francisco, Cal. December 2, 1870.

SPRINGS CHIEFLY DESIGNED FOR RAILWAY AND OTHER CARRIAGES.—P. Sarsfield Devlan, Jersey City, N. J., and Isaac Pennington Wendell and S. P. M. Tasker, Philadelphia, Pa. December 15, 1870.

LIFE-PRESERVING CLOTHING.—Clark Spencer Merriman, Valesca, Iowa. December 8, 1870.

MACHINERY FOR CUTTING LOAF SUGAR.—George Henry Moller, New York city. December 1, 1870.

WIRE BANDS FOR FASTENING BALES.—Edwin Sewall Lenox, New York city. December 13, 1870.

ELECTRIC BRAKE FOR RAILWAYS.—Joseph Olmstead, Chicago, Ill. December 13, 1870.

PROCESS OF ELIMINATING THE COLORING MATTER OF GARANCINE AND OTHER PRODUCTS OF MADDER.—Spencer Borden, Fall River, Mass. December 15, 1870.

# Official List of Patents.

## ISSUED BY THE U. S. PATENT OFFICE.

FOR THE WEEK ENDING JAN. 3, 1871.

*Reported Officially for the Scientific American.*

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**MUNN & CO.,**
**Patent Solicitors, 37 Park Row, New York.**

110,617.—FLIER FOR SPINNING MACHINE.—T. T. Abbott and John A. V. Smith, Manchester, N. H.
110,618.—MOLE TRAP.—John Adams, Greencastle, Ind.
110,619.—STONE DRAG.—Elijah C. Allen, Deerfield, Mass. Antedated Dec. 21, 1870.
110,620.—SEEDING MACHINE.—Asher S. Babbit (assignor to Babbit, Hinckley & Co.), Keesville, N. Y. Antedated December 29, 1870.
110,621.—FETTER OR CLOG FOR FOWLS.—Sanford J. Baker, Madison Centre, Me.
110,622.—PUMP.—Joel R. Bassett, Cincinnati, Ohio.
110,623.—MACHINE FOR MARKING SQUARES.—Charles S. Bement, Southington, assignor to Hart Manufacturing Co., Kensington, Conn.
110,624.—CUTTER FOR NAIL-CUTTING MACHINES.—Eleazar Bless, Indianapolis, Ind.
110,625.—SHOT-CASE AND DISTRIBUTER.—Sinclair Booton, Seguin, Texas.
110,626.—COMPOUND FOR CULINARY USE.—Henry W. Bradley, Binghamton, N. Y.
110,627.—RENDERING AND TREATING OFFAL AND OTHER ANIMAL SUBSTANCES.—Duncan Bruce (assignor to Emma Bruce), Brooklyn, N. Y.
110,628.—PAINT BRUSH.—William B. Burnett, New York city.
110,629.—HOG SNOUTER.—John C. Campbell and Warren S. Bruce, Good Hope, Ill. Antedated December 30, 1870.
110,630.—PILL MACHINE.—Pierre Cauhape, New York city.
110,631.—PAPER-CUTTING MACHINE.—John E. Coffin (assignor to F. W. Bailey and James Noyes), Portland, Me.
110,632.—BEDSTEAD FASTENING.—Charles S. Comins, Lowell, Mass.
110,633.—FASTENING FOR EAVES TROUGHS.—Leonard Cook, Shreveport, La.
110,634.—SEEDING MACHINE.—Jackson Cozad, Corydon, Iowa.
110,635.—FLOUR BOLT.—Robert W. Cunningham, Chesterville, Ohio.
110,636.—COTTON PLANTER AND MANURE DISTRIBUTER.—N. Donaldson, Line Creek, S. C.
110,637.—REVERSIBLE LATCH.—Heinrich Dotzenroth, Pittsburgh, Pa.
110,638.—REFINING PETROLEUM.—Richard Eaton, Montreal, Canada.
110,639.—PROTECTING THE HEARTHS OF FURNACES.—H. W. Ellicott, Baltimore, Md.
110,640.—LOOM.—Robert Elliott, Chester, Pa.
110,641.—VENTILATOR.—William Ennis, Philadelphia, Pa..
110,642.—DOVETAILING MACHINE.—Harry E. Evarts, Chicago, Ill.
110,643.—ALARM FOR LOCOMOTIVE ENGINES.—R. A. Filkins, North Adams, Mass.
110,644.—COMBINED COTTON-SEED PLANTER AND GUANO DISTRIBUTER.—Lafayette Gantt, Camilla, Ga.
110,645.—GLASS TELEGRAPH INSULATOR.—John Garity, East Birmingham, Pa.
110,646.—GATE.—Robert Gidley, Lagrangeville, N. Y.
110,647.—HAND-HOLE CAP FOR STEAM BOILERS.—Wm. W. Graham, Boston, Mass., assignor to himself and J. S. Parsons, Windham Conn.
110,648.—LAMP.—Franklin T. Grimes, Liberty, Mo.
110,649.—CLOTHES PIN.—George Alfred Harris, Buchanan, Mich.
110,650.—SAW SET.—Henry A. Harris, Center, Texas. Antedated December 23, 1870.
110,651.—FOLDING LAMP SHADES.—Henry M. Hartshorn Malden, Mass. Antedated December 30, 1870.
110,652.—COMPOSITION FOR PRESERVING WOOD.—William Hayman (assignor to himself and William R. Black), Taunton, Mass.
110,653.—RECLINING AND ROCKING CHAIR.—Samuel Hayward, Boston, assignor to himself and Luther E. Kimball, Cambridgeport, Mass.
110,654.—BASE-BURNING FIRE-PLACE HEATER.—E. S. Heath Baltimore, Md.
110,655.—DROP-HAMMER LIFTER.—Francis M. Hodge, Shelburne Falls, Mass. Antedated December 24, 1870.
110,656.—KNITTING MACHINE.—Wm. H. Hollen, Fostoria Pa.
110,657.—CALIPER.—William P. Hopkins, Lawrence, Mass.
110,658.—THRASHING MACHINE.—Hiram E. Hurlburt, Hammondsport, N. Y. Antedated December 20, 1870.
110,659.—DOUBLE HINGE.—John S. Jenness, Bangor, Me.
110,660.—SUBSOIL PLOW.—Marquis R. Jones, Walworth, Wis. Antedated December 31, 1870.
110,661.—MILKING STOOL.—Richard W. Jones and John B Baker, Syracuse, N. Y.
110,662.—APPARATUS FOR THE MANUFACTURE OF BROMINE.—John J. Juhler, Natrona, Pa.
110,663.—RUT LEVELER.—Calvin Marshall, North Easton, Mass.
110,664.—HOT-AIR FURNACE.—Peter Martin, Cincinnati, Ohio.
110,665.—COMPOSITION FOR ROOFING.—J. B. Melvin, Lowell, Mass.
110,666.—PURIFICATION OF CAST IRON.—J. W. Middleton, Philadelphia, Pa. Antedated December 22, 1870.
110,667.—MOTIVE-POWER APPARATUS.—C. A. Mills, Bridgeport, Conn.
110,668.—HOT-WATER FEEDER FOR STEAM BOILERS.—J. H. Mills, Boston, and John Howarth, Salem, Mass.
110,669.—SEWING MACHINE FOR WORKING BUTTON HOLES.—Eugene Moreau, San Francisco, Cal., assignor to himself, J. W. Haggerty, and Samuel Hill.
110,670.—TUCKING DEVICE FOR SEWING MACHINES.—Aaron Morehouse, Hartford, Conn.
110,671.—SAW TABLE.—Peter Neeb, Buffalo, N. Y., assignor, by mesne-assignment, to Margaret Neeb.
110,672.—FLOUR SIFTER.—Lucy Sawyer, Templeton, Mass. Antedated December 17, 1870.
110,673.—WAGON BRAKE.—Andrew Van Der Hyden Oliver Bethlehem, N. Y.
110,674.—BELT SHIPPER.—J. L. Otis, Leeds, Mass.
110,675.—PRINTING TELEGRAPH.—G. M. Phelps, Brooklyn, N. Y., assignor to the Western Union Telegraph Company, New York city.
110,676.—SPARK ARRESTER.—C. L. Pierpont, Durand, Wis.
110,677.—LUBRICATOR.—William Pratt, Providence, R. I. and N. B. Williams, New York city, assignors to A. A. Williams, Brooklyn, N. Y.
110,678.—CHURN.—J. H. Reed, La Fayette, Ind.
110,679.—CORN PLANTER.—John Reichelderfer, Cridersville Ohio, administrator of Philip Kuntz, deceased.
110,680.—MANUFACTURE OF ACID PHOSPHATES FOR USE IN BAKING POWDERS, ETC.—N. B. Rice, East Saginaw, Mich.
110,681.—STEAM ENGINE.—Thomas Ross, Rutland, Vt.
110,682.—CULTIVATOR.—Jacob Sattison, Ripley Township Ohio.
110,683.—WINDMILL.—Edvard Savoral, New York city. Antedated December 31, 1870.
110,684.—CASTING BAR SOLDER.—Abraham Schoenberg, New York city.
110,685.—DIES FOR FORMING HORSE-COLLAR SHELLS.—J. W. Schwaner, Egg Harbor City, N. J.
110,686.—SHUTTER FASTENING.—P. T. Share, Baltimore, Md
110,687.—GATE.—G. A. Slater, Benton Harbor, Mich. Antedated December 30, 1870.
110,688.—SEED DROPPER.—H. M. Smith, Richmond, Va.
110,689.—PATTERN FOR MOLDING STOVE LIDS.—Samuel Smith (assignor to himself and Charles Noble & Co.), Philadelphia, Pa.
110,690.—LUBRICATING COMPOUND.—J. H. Smyser, Pittsburgh, Pa.
110,691.—CLOTHES DRYER.—H. M. Stevenson, South Peacham, Vt.
110,692.—REVERSIBLE PLOWS.—G. W. Thompson, Ripley, Ohio.
110,693.—EXTENSION PLOWSHARE.—G. W. Thorp, Columbus, Kansas.
110,694.—SEED PLANTER AND GUANO DISTRIBUTER.—H. L Tillery, Halifax, N. C.
110,695.—PRINTERS' FURNITURE.—R. B. Topham, D. C.
110,696.—PLATFORM SCALE.—J. H. Truex, Rochester, N. Y.
110,697.—FOLDING BEDSTEAD.—Joshua Turner (assignor to B. A. Pettingill and I. S. Pear), Cambridgeport, Mass.
110,698.—WHEELBARROW FRAME.—B. W. Tuthill, Oregon City, Oregon.
110,699.—PLAITING DEVICE FOR SEWING MACHINES.—William Walker, Brooklyn, N Y., assignor to G. B. Wooster, New York city.
110,700.—ALARM ATTACHMENT FOR MACHINES FOR FORMING HAT BODIES.—W. C. Waring, Yonkers, N. Y.
110,701.—HEEL-TAP FOR BOOTS AND SHOES.—Alexander Warner, Brooklyn, E. D., N. Y.
110,702.—DRYING OIL-CLOTHS AND SIMILAR FABRICS.—O. C. Washburn (assignor to Thomas Potter), Philadelphia, Pa.
110,703.—GOVERNOR FOR STEAM ENGINES.—Charles Waters, Boston, Mass.
110,704.—CONSTRUCTING MOLDINGS OF PAPER.—W. W. Webster, Chelsea, Mass.
110,705.—SAW.—Thomas Welham, Philadelphia, Pa. Antedated December 17, 1870.
110,706.—SEED PLANTER.—W. F. West, Haverstraw, N. Y.
110,707.—BAG-FILLING AND WEIGHING MACHINE.—C. A. Whelan and C. T. Wakeley, Madison, Wis.
110,708.—SAD-IRON HEATER.—Lewis Wilkinson, New York city.
110,709.—CHILDREN'S HOBBY-HORSE.—Wm. A. Williams, New York city.
110,710.—APPARATUS FOR MAKING EXTRACTS FOR TANNING.—Riley P. Wilson, New York city.
110,711.—COVER AND TABLE FOR SEWING MACHINES.—F. R. Wolfinger, Chicago, Ill.
110,712.—GUIDING WHEEL FOR HARVESTERS.—Walter A. Wood and William Anson Wood, Hoosick Falls, N. Y.
110,713.—HARVESTER.—Walter A. Wood, Wm. A. Wood, and John M. Rosebrooks, Hoosick Falls, N. Y.
110,714.—HARVESTER.—Walter A. Wood, Wm. A. Wood, and John M. Rosebrooks, Hoosick Falls, N. Y.
110,715.—HARVESTER.—Walter A. Wood, Wm. A. Wood, and John M. Rosebrooks, Hoosick Falls, N. Y.
110,716.—HARVESTER-RAKE.—William Anson Wood, Hoosick Falls, N. Y.
110,717.—CAR-WHEEL MOLD.—Wm. E. Worth, San Francisco, Cal.
110,718.—HARVESTER.—Charles M. Young, Meadville, Pa.
110,719.—MUSICAL NOTATION FOR ACCORDEONS.—Carl F Zimmermann, Philadelphia, Pa.
110,720.—SEEDING MACHINE.—D. S. Alvord, Austinburg, and Charles D. Hollis, Ashtabula, Ohio.
110,721.—MEAT CUTTER.—Jeremiah S. Artley, Danville, Pa
110,722.—IRON PLOW BEAM.—Albert Ball, Canton, Ohio. Antedated December 29, 1870.
110,723.—CAR REPLACER.—David H. Ball and John Brooks, Steamahoning, Pa.
110,724.—GRAIN DUMPING CAR.—Leonard Bammerlin, Massillon, Ohio.
110,725.—REIN HOLDER.—Wm. Barstow, San Francisco, Cal Antedated December 30, 1870.

110,726.—CURTAIN BRAKE.—T. S. Bailie and G. H. Maurer, Washington, D. C.
110,727.—COATING AND DECORATING PAPER, CLOTH, AND OTHER MATERIALS.—Frederick Beck, New York city.
110,728.—SASH HOLDER.—John H. Bloodgood, Bridgeport, Conn.
110,729.—GAS APPARATUS.—Abraham L. Bogart, New York city.
110,730.—SHUTTLE FOR SEWING MACHINES.—F. W. Boland, New York city.
110,731.—HOT-AIR FURNACE.—Lansing Bonnell, Milwaukee, Wis.
110,732.—CIGAR MOLD.—Nicholas H. Borgfeldt, New York city.
110,733.—FASTENER FOR MEETING-RAILS OF SASHES.—Elias K. Breckenridge, West Meriden, Conn.
110,734.—MANURE FORK.—A. S. Brinser and Henry Bricker, Falmouth, Pa.
110,735.—SEWING MACHINE.—William H. Buker, Johnstown, N. Y.
110,736.—COMBINED CULTIVATOR AND PLANTER.—Peter Burress, Braidwood, Ill.
110,737.—HEMMER FOR SEWING MACHINES.—Cyrus Carleton, Brooklyn, N. Y., assignor to Wilcox & Gibbs Sewing Machine Company, New York city.
110,738.—PRESERVING WOOD.—Thomas W. Chandler (assignor to himself and Nicholas De Peyster), New York city.
110,739.—SEWING MACHINE FOR WORKING BUTTON-HOLES.—Sherman Clemmshaw, Troy, N. Y.
110,740.—BINDER FOR SEWING MACHINES.—Jacob L. Coles, Newark, N. J.
110,741.—AUTOMATIC CAR COUPLING.—David Pitkin Cory (assignor to himself and Josiah Crane, Jr.), Cranford, N. J.
110,742.—HARVESTER.—William Robert Cory, Springfield, Ill.
110,743.—BOOT JACK.—John Crabtree, Cincinnati, Ohio.
110,744.—CHILDREN'S CARRIAGE.—John C. Crandall, New York city.
110,745.—CHILDREN'S CARRIAGE.—William E. Crandall, New York city.
110,746.—RAILWAY-CAR SEAT.—William Crandell, Westfield, N. Y.
110,747.—DOOR FOR RANGES.—Royal E. Deane and Thomas Shedd, New York city.
110,748.—MACHINE FOR BENDING METAL STIRRUPS.—John H. De Valin, Baltimore, Md.
110,749.—WASHING MACHINE.—Samuel De Veau, Syracuse, N. Y.
110,750.—GATE.—Albert Jason Dimick, Berlinville, Ohio.
110,751.—HANDLE FOR CROSS-CUT SAW.—Thomas S. Disston (assignor to himself and Henry Disston & Son), Philadelphia, Pa.
110,752.—QUADRAT.—William Donald, Erie, Pa.
110,753.—FEED-WATER PIPE.—John Doyle, Baltimore, Md.
110,754.—TUG FOR TOWING BOATS.—Walter Everson, New York city.
110,755.—SPIKE MACHINE.—David Eynon, Richmond, Va.
110,756.—SPIKE MACHINE.—David Eynon (assignor to Tredegar Company), Richmond, Va.
110,757.—FRUIT CAN.—Reuben G. Farnham (assignor of one half his right to Russell B. Wheeler), Elbridge, N. Y.
110,758.—PLOW.—Nelson Faught, Pittsborough, Ind.
110,759.—EXCAVATOR.—David Gilmore and William W. Forrest (assignors to George Lalilow), Peotone, Ill.
110,760.—PRECAUTIONARY ATTACHMENT FOR BOTTLES CONTAINING POISON.—Joseph Harrison, Philadelphia, Pa.
110,761.—DEVICE FOR NICKING SCREW CAPS.—William Hillhouse and George W. Briggs (assignors to "The Grilley Company"), New Haven, Conn.
110,762.—DEVICE FOR CULTING SOLES FOR BOOTS AND SHOES.—Archelaus M. Howe, Worcester, Mass.
110,763.—BROILER.—Michael T. Hynes, Boston, Mass.
110,764.—HOLLOW BRICK.—Geo. H. Johnson, New York city.
110,765.—CARPENTERS' SHOOTING BOARD.—Joseph Jones, Newark, N. J.
110,766.—CARRIAGE AXLE.—Henry Killam, New Haven, Conn.
110,767.—EYELETING MACHINE.—Albert Komp, New York city.
110,768.—METALLIC HEEL.—Austin S. Mann, St. Louis, Mo.
110,769.—IRONING TABLE.—Daniel W. Marshall, Pawtucket, R. I.
110,770.—FARE RECORDER FOR CARS, ETC.—George R. Metten, Cleveland, and Oscar S. Pease, Xenia, Ohio; said Metten assignor to said Pease.
110,771.—HORSE HAY RAKE.—Charles Rollin Merriam, Middlebury, Vt., assignor to himself and W. H. Merriam, Stratford, N. H.
110,772.—CORN HUSKER.—Abel Merwin, St. Joseph, Mich.
110,773.—METHOD OF FORMING BODY LOOPS FOR CARRIAGES.—Robert R. Miller, Plantsville, Conn.
110,774.—COMPOUND FOR DESTROYING WORMS IN THE COTTON PLANT.—Thomas W. Mitchell (assignor to himself and Robert P. Briscoe), Richmond, Texas.
110,775.—STREET SPRINKLER.—William C. Moores (assignor of two thirds of his right to Gilbert Pullen, Washington, D. C.
110,776.—CAR COUPLING.—Joseph Mount, Monroe Township, N. J.
110,777.—MACHINE FOR CUTTING THE ENDS OF WOODEN PENCILS.—Telle H. Muller (assignor to Joseph Reckendorfer), New York city.
110,778.—LIGHTNING ROD.—David Munson, Indianapolis, Ind.
110,779.—CASTING CAR WHEELS.—Chandler Needham, Worcester, Mass.
110,780.—CAR STARTER.—William Harrison Newton, Newport, R. I.
110,781.—HEATING STOVE AND DRUM.—William H. Nobles (assignor to himself and C. D. Williams), St. Paul, Minn.
110,782.—HAIR PUFF OR ROLL.—Joseph D. Oppenheimer, Philadelphia, Pa.
110,783.—FASTENING FOR BRACES, ETC.—Edward Lawley Parker, Birmingham, England.
110,784.—MILK HOUSE.—Henry Peregoy, Mount Carmel, Md.
110,785.—STEP LADDER.—William G. Philips, Newport, Del.
110,786.—CORN PLANTER.—Fielding W. Poe, Jr., Vandalia, Ill.
110,787.—WINDOW SHADE.—Ansel W. Porter, Union City, Ind.
110,788.—CORN PLANTER.—Jacob R. Randall, Camargo, Ill.
110,789.—WRENCH.—John F. Robertson (assignor of two thirds his right to James H. Holly and John G. Knapp), Warwick, N. Y.
110,790.—MACHINE FOR SEWING OR WORKING BUTTON HOLES.—Charles E. Robinson, Boston, Mass.
110,791.—FRAME FOR TRAVELING BAGS, ETC.—William Roemer Newark, N. J.
110,792.—TARGET GAME.—John C. Schooley, New York city.
110,793.—STEERING APPARATUS.—John C. Schrader and Carl L. Mathiesen, New York city.
110,794.—STREET PAVEMENT.—William E. Shaw, Portland, Me.
110,795.—WARPING MACHINE.—Thomas Singleton, Over Darwen, England.
110,796.—HYDRAULIC ENGINE.—William Snyder, Bullskin Township, Pa.
110,797.—RAILWAY RAIL CHAIR.—William H. Staats, Crescent, assignor of one half his right to Rufus Lape and Charles A. McLeod, Troy, N. Y.
110,798.—ENVELOPE.—Robert Sherwood Stubbs, Lisbon, N. H.
110,799.—MOWING MACHINE.—Zuriel Swope, Lancaster, Pa.
110,800.—APPARATUS AND PROCESS OF CLEANING COTTON WASTE, ETC.—George W. Sylvester, Belleville, N. J.
110,801.—MEAT CHOPPER AND VEGETABLE SLICER.—James M. Taft, Arcadia, Wis.
110,802.—CLOTHES LINE HOLDER.—Ezra W. Talbot (assignor to himself and James W. Miller), Napoleon, Ohio.
110,803.—RAILROAD CAR VENTILATOR.—Clark P. Tillinghast, Providence, R. I.
110,804.—SODA WATER FOUNTAIN.—Antony Tumler, New York city.
110,805.—SCHOOL DESK AND CHAIR.—Alexander Sidney Vaughan, Elkton, Md.
110,806.—APPARATUS AND PROCESS FOR DISTILLING OIL.—William G. Warden, Philadelphia, Pa.
110,807.—COTTON PLANTER.—Dwight F. Welsh, Nevada, Ohio.
110,808.—RAILWAY SWITCH.—William Wharton, Jr., Philadelphia, Pa.
110,809.—BEE HIVE.—John Wheeldon, Greensburg, Ind.
110,810.—ATTACHMENT FOR SEWING MACHINE.—William H. White (assignor of one half his right to I. Wellington Hoyer), Baltimore, Md.
110,811.—CORN PLANTER.—Joseph M. Whitmore and John N. Arvin, Valparaiso, Ind.
110,812.—MACHINE FOR WRAPPING "KISSES," ETC.—Charles C. Wilson, Baltimore, Md.
110,813.—CUT-OFF VALVE FOR STEAM ENGINES.—George S. Young (assignor to himself and Al Fitch Boynton), Clearfield, Pa.
110,814.—MILL-SPINDLE STEP.—George S. Young (assignor to himself and Al Fitch Boynton), Clearfield, Pa.

## REISSUES.

4,223.—CHILDREN'S CARRIAGE.—William E. Crandall, New York city. Patent No. 100,121, dated Feb. 22, 1870; reissue No. 3,972, dated May 17, 1870.
4,224.—SECURING RAILWAY-RAIL JOINT.—Lyman Fay, Worcester, Mass., assignor to Joseph M. Rice, same place, and Daniel R. Pratt, New York. Patent No. 35,507, dated June 17, 1862.
4,225.—Division A.—INSTRUMENT FOR DRAFTING GARMENTS.—Ursula Louise Leete, New Haven, Conn. Patent No. 107,068, dated Sept. 6, 1870.
4,226.—Division B.—INSTRUMENT FOR DRAFTING GARMENTS.—Ursula Louise Leete, New Haven, Conn. Patent No. 107,068, dated Sept. 6, 1870.
4,227.—CLOTHES WASHER.—Ariadna B. Mercier, Providence, R. I. Patent No. 56,773, dated July 31, 1870.
4,228.—PUNCH.—Isaac P. Richards, Whitinsville, Mass. Patent No. 104,769, dated June 28, 1870.
4,229.—BLANK FOR AND DIE FOR MAKING MOLD BOARDS FOR PLOWS.—William Medd Watson, Tonica, Ill. Patent No. 109,825, dated March 15, 1870.

## DESIGNS.

4,547 to 4,550.—CARPET PATTERN.—Robert R. Campbell (assignor to Lowell Manufacturing Company), Lowell, Mass. Four Patents.
4,551.—HAIR PIN.—William F. Fluhrer, New York city.
4,552 and 4,553.—TYPE.—Julius Herriet (assignor to David Wolf Bruce), New York city. Two Patents.
4,554.—EGG STEAMER.—William Kirkham, Springfield, Mass.
4,555.—SHAWL.—Charles H. Landenberger, Philadelphia, Pa.
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4,557.—LAND MARK.—John H. Parrish, Greensborough, Ala.
4,558.—COLLAR-BOX COVER.—Pulaski B. Pickens, New York city.
4,559 to 4,561.—TYPE.—Richard Smith (assignor to MacKellar, Smiths & Jordan), Philadelphia, Pa. Three Patents.
4,562.—CHAIN HOOK.—George D. Stevens, New York city.

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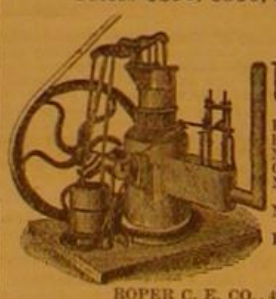
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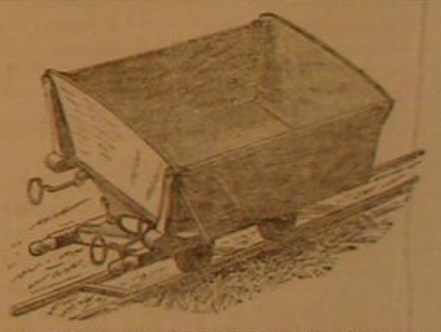

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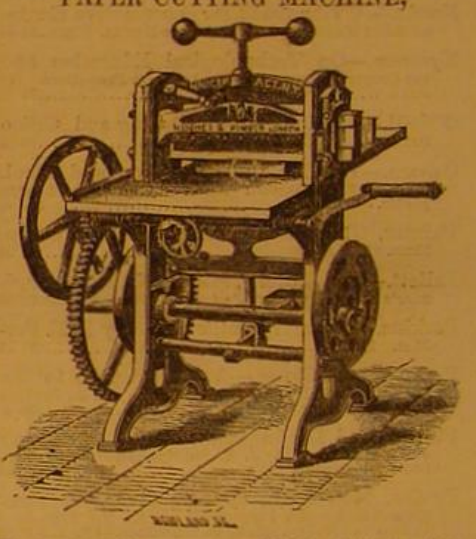

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Vol. XXIV.—No. 4. [NEW SERIES.] NEW YORK, JANUARY 21, 1871. $3 per Annum. [IN ADVANCE.]

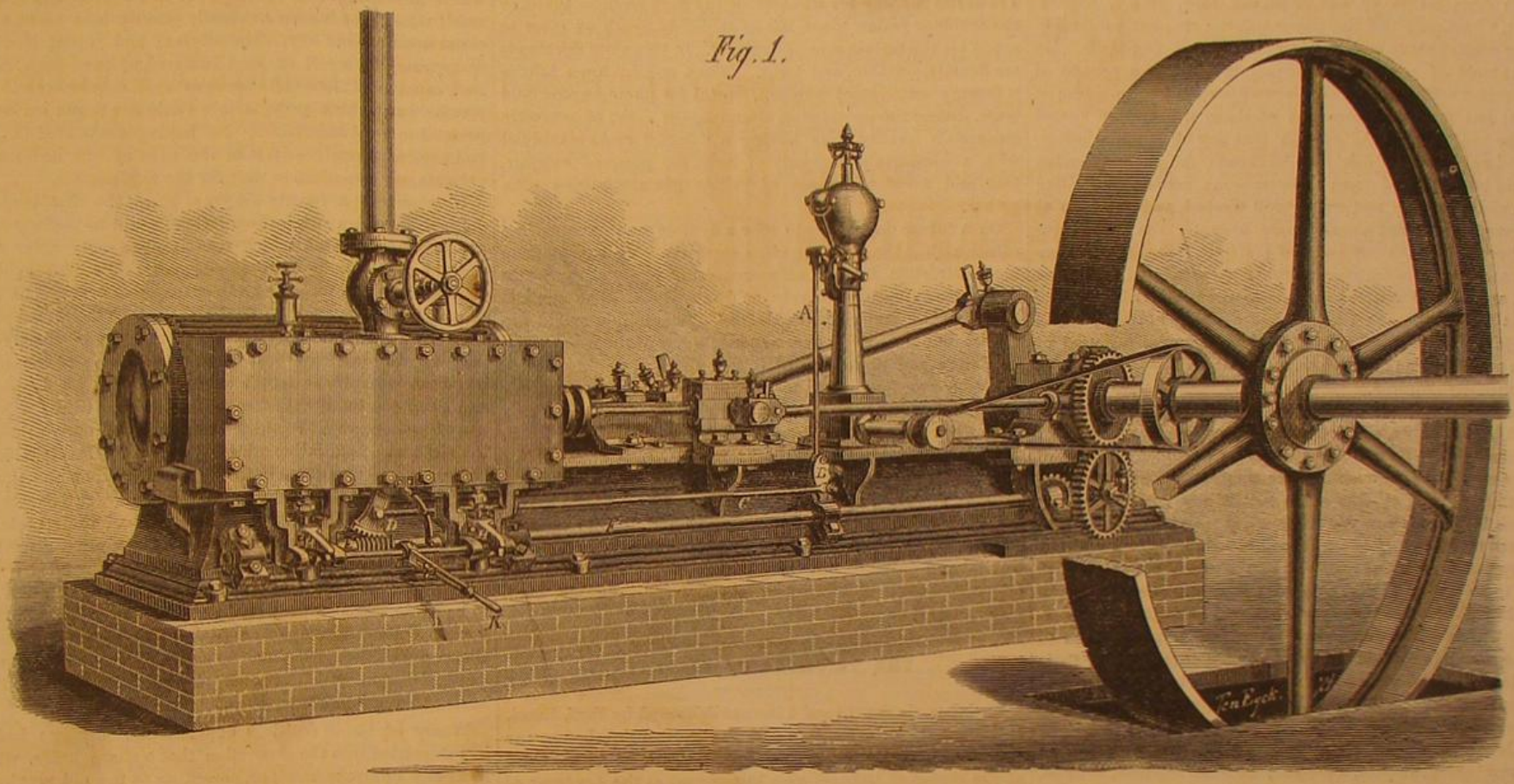

### Watts and Phelps' Variable Cut-off.

Our engineering readers will be interested in the engravings we herewith present of a new variable cut-off, invented by Wm. Watts and Fred. A. Phelps, of Newark, N. J.

The motions of this new valve gear are all positive, and the parts are all not only strong and durable, but easily adjusted to equalize the cut-off at each end of the cylinder. It has nothing about it which seems likely to get out of order, and its operation (as shown by indicator diagrams taken from an engine, with this gear attached, by Mr. F. W. Bacon, whose engineering skill is familiar to many of our readers), gives economical results which justly rank as first-class, notwithstanding its freedom from the complications which, in many kinds of valve gear, necessitate constant attention and frequent repair.

The controlling power of the governor is transmitted through the connecting rod, A, Fig. 1, the sector, B, the connecting rod, C, and the toothed sector, D, to a cylindrical rack turned on the sleeve, E. The sleeve, E, is feathered to the shaft, F, and slides longitudinally when acted upon by the parts, A, B, C, and D, while turning with the shaft, F, the rotation of the latter being accomplished through a system of gearing, as shown.

*Fig. 1.*



WATTS AND PHELPS' VARIABLE CUT-OFF.

The sleeve, E, also carries two cams, shown in section in Fig. 2, at G, which, turning under the toes of tappet arms, H, Figs. 1 and 2, attached to the vertical stems, I, Fig. 2, of the cut-off valves, J, Figs. 2 and 3, raise the valves and let them fall abruptly at the proper point of cut-off to which they are adjusted.

*Fig. 2*

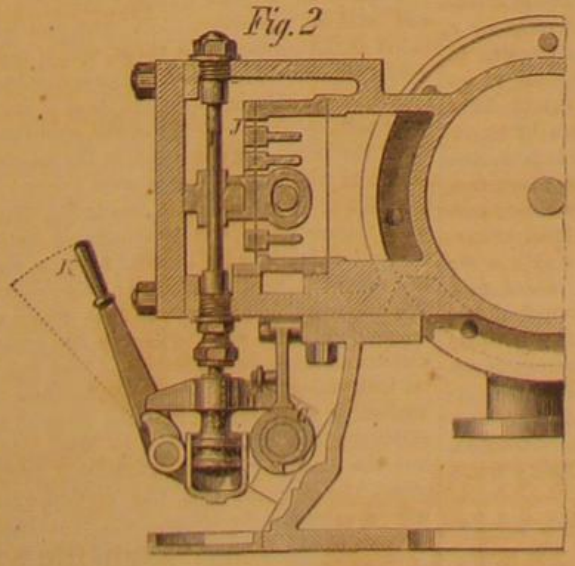
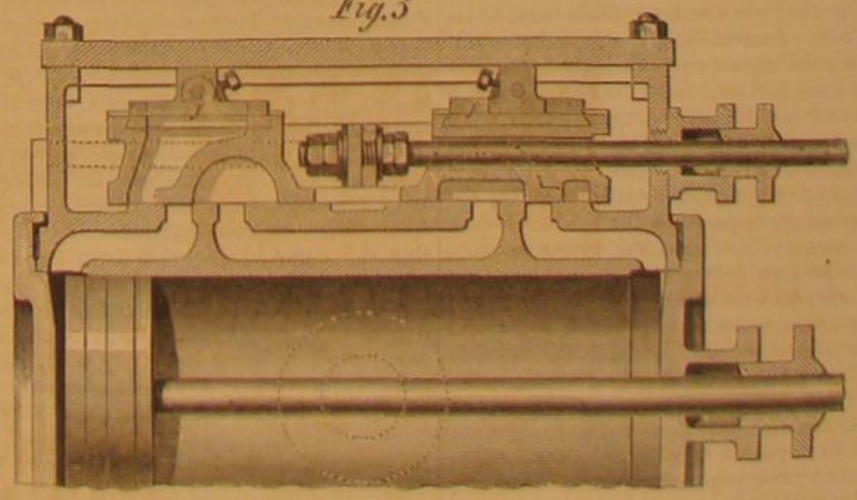


*Fig. 3*



The cut-off valves, J, are of the "grid" variety, and slide on the backs of the principal valves, which latter are actuated in the usual way from an excentric on the crank shaft.

The sliding of the sleeve, E, on the shaft, F, causes the cams to let the cut-off valves fall earlier or later in the stroke, according as varying velocity affects the governor.

If the the belt break or any other derangement of the governor occur, the travel of the sleeve, being a little more than the length of the cam, allows the toes of the tappet arms to drop off the cam on to the shaft, closing the cut-off valve ports and instantly stopping the engine. In starting the engine, a lever and cam, K, Figs. 1 and 2, is used to raise the cut-off valve and open the port. The motion of the engine then operating on the governor draws the sleeve along so as to bring the cams under the tappets, and thenceforward the gear works automatically.

It will be seen that this gear can be made to cut off from zero to any part of the stroke desired, and that it can be adapted to many kinds of engines in popular use, with but slight alteration.

Fig. 3 is a horizontal section through the cylinder and valve chest which aids in showing the relations of the parts.

As an illustration of the effectiveness of this valve gear we may say that with a double cylinder engine, having cylinders five feet by twenty-eight inches, running at forty-seven revolutions per minute, in a large thread factory, in Newark, N. J., much difficulty was at first experienced on account of the variable power required to drive the machinery. The variations were so great that it was found impossible to govern the engine by the throttle-valve governor.

The application of the valve gear we have described, in connection with a medium-sized Porter's patent governor, has reduced this variation, so that, including the variation arising from inexactness in starting the engine at the precise moment for work to commence, and stopping at the end of each half day, its maximum irregularity does not exceed ten revolutions per day of ten and one half hours, as determined by a counter and attested by the engineer in charge.

The cut-off is extremely sharp, as shown by the diagrams, and the work required of the governor is very slight, it being only that required to overcome the friction of the connections, and to move the sleeve longitudinally on the shaft, F, as above described. As a consequence the action of the governor is delicate and sensitive to very slight variations in speed. These engines are manufactured by Watts, Campbell & Co., proprietors Passaic Machine Works, corner Passaic and Ogden streets, Newark, N. J., who may be addressed for rights or further information.

### French Ironing Table.

A French mechanic, resident in Algiers, has, it is said, recently invented an ironing table, by which, after the articles have been cleansed, steam can be directly applied during the iron process, for the purpose of producing a fine finish. The ironing table is hollow, of a long, oval shape, and is composed of metal. The surface is slightly curved, and is perforated with many small holes. Steam is conveyed to the interior of the table by means of a pipe leading from a generator placed upon a small furnace, at which the irons are heated. The method of ironing is conducted as follows: The article is spread over the table, the key in the steam pipe is opened, and the steam, rushing into the hollow interior of the table, escapes through the small holes, and penetrates the fabric from below, while the operator is passing the hot flat-iron over the upper surface. This process, it is stated, produces a very fine steam finish, equal to that of new goods, and a great saving of time over the old methods is effected. The total cost of the entire apparatus, that is, a steam generator, a furnace, and two tables, is about $200. It may be mentioned, that the second table is made of a shape especially adapted for ironing pantaloons. The cost of this apparatus precludes its use for general domestic purposes. In laundries and dyeing establishments it would be serviceable.

## XYLONITE.

[By Daniel Spill, before the London Photographic Society, Dec. 13, 1870.]

The name "Xylonite" is taken from the Greek word *xulon*, "wood," and the material upon which this name has been bestowed is derived from wood or woody fibers. These are converted by the action of mixed nitric and sulphuric acids into a rough form of xyloidine, which, being subsequently dissolved into a species of collodion, constitutes the base of a further manufacture.

The material was first introduced to the notice of the public at the International Exhibition of 1862, by Mr. Alexander Parkes, of Birmingham, at which time it had not yet become an article of commerce; subsequently it was manufactured on a commercial scale, and introduced to the world for a short time under the name of "Parkesine" (named after the inventor). The manufacture having been much improved, and the patented solvents and machinery almost entirely remodeled, it was considered advisable that the name should also be changed, and "Xylonite," as being more appropriate for a derivative of xyloidine, was adopted.

The soluble base of this manufacture may be made from any wood or woody fiber, or fiber-producing grasses, old rags, waste from cotton or flax mills, old rope, starch, Esparto grass, "half-stuff" of the paper-makers, etc., but preferably using waste fibrous material from cotton and flax mills. No doubt most of you are well acquainted with the process of converting cotton into a soluble modification by the action of acids; but for the information of those who are not versed in the matter, I would explain that any one of the before-named substances which may be chosen for the conversion should be first freed from all extraneous matter, by boiling with alkali or soap and water, well washed, and dried, so as to leave nothing but a nearly pure fiber for the subsequent treatment. A bath composed of one part, by weight, of concentrated nitric acid, four parts of concentrated sulphuric acid, and one of water, having been prepared and cooled to about 70° or 80° Fah.; a weighed quantity of the purified vegetable fibers is then immersed therein for a period of from one to fifteen minutes or longer, according to the degree of solubility required.

The next step is to remove the uncombined acids as quickly as possible, either by draining or pressure (the latter preferred), and then wash quickly in a copious supply of water until the last washings are neutral to test paper. If the fiber should at this stage retain any coloring matter (which is not unfrequently the case), it may be submitted to the action of any of the ordinary bleaching agents without injury to the chemical condition of the xyloidine, which has now to be carefully dried at a low temperature or by pressure (the latter being preferred), when it will be ready for dissolving. The solvents commonly employed in the preparation of photographic collodion are too expensive to permit of their use in the xylonite manufacture, and we have recourse to solvents, either fixed or volatile, or judicious mixtures of both these qualities, by which an almost endless variety of materials can be prepared. The volatile solvents mostly used are wood-spirit, alcohol, aldehyde, mineral naphtha, benzole, and other hydrocarbons; and the non-volatile or fixed solvents are oil and camphor, or natural camphor-oil, linseed, castor, and other vegetable oils.

The introduction of these fixed solvents is an important improvement and economy in the manufacture of xylonite, obviating much loss by evaporation and inconvenience arising from contraction of the material. To prepare these solvents take, say, 100 parts of castor oil and heat up to about 250° or 300° Fah., then dissolve therein about fifty parts of camphor, and while in the heated condition add the xyloidine, which readily dissolves into a stiff paste, and is then ready for a subsequent process. The condition of xylonite may be varied from the flexibility of morocco leather to the hardness of ivory or stone by the judicious combination of xyloidine, oil, and pigments.

Having explained the mode of preparing xyloidine, its nature, and properties, and those of its solvents, I will now treat of the conversion of the xyloidine into xylonite and of its application to the arts. Practically, in our manufacture, it is not necessary to dry the xyloidine thoroughly before dissolving it; pressure alone will remove 90 per cent of its moisture, and in this state it is quite uninflammable, even when held in contact with fire, and yet will readily dissolve in the before-mentioned solvents. Five parts of solvent will reduce one part of xyloidine into a stiff paste by stirring alone; but to blend the materials more perfectly the mixture is masticated or ground between rollers until the incorporation is completed; it is next removed into a strong vessel having a perforated bottom covered with a finely-woven wire sieve, which vessel is then placed beneath the piston of a powerful press, and the paste is thereby forced through the sieve, in order to strain it from all mechanical impurities or undissolved particles of xyloidine. This purified xyloidine is next removed, weighed, and the requisite quantity of oil or pigments added thereto, and then passed to a heated masticator or grinding rolls, or into a retort provided with mechanical stirrers, which, for volatile solvents, are inclosed in an air-tight casing, the latter being in connection with a condenser and vacuum apparatus during the process of mastication or agitation. The volatile solvents are evaporated by the heat and vacuum, and conveyed away to a condenser for future use. When non-volatile solvents are used, the last-named apparatus is not required, heat and mastication being sufficient. When the paste is masticated into a very stiff condition it is removed into a powerful calendering machine, where it is rolled into sheets of any required thickness, after which it is placed in a seasoning-room heated to 100 to 120° Fah. for periods varying from fifteen to thirty days, when it is ready for use.

To produce the mottled or marbled patterns, the paste is first masticated into a stiff dough, each color separately, then rolled into rough sheets, and, while in a plastic condition, weighed quantities of two, three, or more of these colored sheets are piled upon each other in such a way as is needful to obtain the desired pattern, and the whole are passed together through calender rolls, the workmen taking care to relay or fold the sheets between each calendering so as to alter the position of the colors; and the material is finished as already described.

When preparing hard compounds with the non-volatile solvents it is necessary to use oxidized oil, such as linseed oil, which will dry and become hard in the process of seasoning. The flexible kinds are prepared with cotton-seed oil or castor oil, which will not become hard. For coating or water-proofing fabrics, the paste may be applied in a semi-fluid condition with an ordinary india-rubber spreading knife, or machine, or it may be applied in a very stiff paste by the aid of calender rolls.

In preparing non-actinic sheets for photographic purposes, no pigments are used, but semi-transparent colors only, such as will arrest the passage of the chemical rays, and furnish a material suitable for windows of the dark room in place of the ordinary yellow glass, but of sufficient depth of color to arrest all the actinic rays of sunlight. In this state the sheets are flexible, durable, and light. When spread upon fabrics it forms a water-proof material, useful for photographic field tents, giving the operator an abundance of light of perfectly non-actinic quality, thus having a "dark" room combined with a considerable amount of light for personal comfort, fort, and avoiding theuse of yellow glass windows altogether.

On a future day I hope to offer a flexible and structureless substitute for the glass negative supports. My experiments in this direction are not at present sufficiently advanced to enable me to speak positively on the subject. The applications for the material outside the photographic world are almost innumerable; I may instance a few of them—namely, insulation and protection of telegraph wire, coating fabrics for water-proof garments, making artificial leather for furniture covering, and book-binding, writing tablets, substitutes for ivory, bone, horn, tortoiseshell, hard woods, marble, etc., knife-handles, friction and gear wheels, also bearings for machinery, spinners' bosses, billiard-balls, pianoforte-keys, walking stick and umbrella handles, etc.

It may be turned in a lathe or wrought by the cabinet-maker's or brass-finisher's tools; can be embossed or molded by heat and pressure, and may be polished like ivory, wood, or stone. It is unaffected by atmospheric influence, heat, water, or grease.

## THE TRIUMPHS OF SURGERY.

The above is the title of a lecture delivered by Prof. Frank H. Hamilton, M.D., LL.D., of Bellevue Hospital, before the American Institute, Friday evening, Jan. 6th, being the third of the course of lectures now in progress at the Academy of Music. We hardly expected from the pre-announced title of the lecture that it could be made of that popular character which pleases a mixed audience, and we were not disappointed in our expectations. However the lecturer grappled with the difficulties of the task in such a way that relieved the tedium of its unavoidable technicalities to those who are unfamiliar with anatomical terms and on the whole succeeded in holding the interest of his audience better than we at first anticipated.

We shall make only one or two brief extracts from this lecture, as an abstract of the greater portion could scarcely be made without involving ourselves in the same dilemma which the lecturer experienced in translating a discourse purely technical into popular language.

On the head of "Plastic Surgery" the lecturer called attention to the truly wonderful discovery made recently by a young surgeon, M. Reverdin, at the Hospital La Charité, in Paris. He said: There are certain ulcers and wounds of integument which, solely on account of their extent, have hitherto been considered incurable. To illustrate by an example: If the whole of the skin were stripped from the arm no effort of nature or skill of surgery, however long continued, could ever succeed in restoring the tegumentary covering. At least such has been the statement until to-day, and for the following reasons: First, because new skin never forms except from the margins of the old; and second, new skin can never be projected from the old beyond a few inches—perhaps two or three at most. But many examples are presented in surgery in which the integument is destroyed by burns or by machinery to such an extent that repair, limited by these invariable laws, utterly fails to complete the restoration; and great deformity from contraction, a perpetual ulcer, or amputation, have been the only alternatives.

I must be permitted to mention my own humble contributions to the relief of this condition made in the same direction as that of M. Reverdin, but which his more brilliant discovery has completely eclipsed. By a successful operation upon a patient at the hospital of the Sisters of Charity, in Buffalo, in 1854, I demonstrated that a comparatively small piece of skin, perhaps three inches square, taken from one leg and transplanted to an open ulcer upon the opposite leg, which was eight inches square, would, after becoming attached, grow, and increase in size by the projection of new skin from its margins, until the whole ulcer was closed in. This operation has been repeated many times by myself and others since the date of my first experiment, and with similar results. But listen now to what M. Reverdin has done. He has taken a piece of skin not larger than a lentil seed from the arm of a patient, and inserting it in the midst of the raw, granulating flesh of an ulcer, it has become the center from which new skin has been formed, and has extended on all sides; and by making several of these minute insertions, the whole sore has become speedily cicatrized.

Assisted by my house surgeon, Dr. Williams, I have repeated these operations at the Charity Hospital already more than fifty times, the results of which experiments have been published in the *New York Medical Gazette*. My first patient refused to submit to the operation, fearing that the excision of the piece of skin would be painful; but having cut a small piece from my own arm, he permitted me to insert it into his open wound. This trivial operation, made in the presence of a large number of others suffering from chronic ulcers, gave them an assurance that it was almost painless and bloodless, and no further difficulty was experienced in prosecuting the experiments.

We had but six successes from this large number of transplantations, but the principal causes of failure have been ascertained, and will be avoided hereafter. What is most remarkable in this thing is that the minute piece thus implanted seems to fall off in a few days; but at the point where it rested, after the lapse of a week or two more, a small white spot is seen gradually coming into view, like a cloud upon a clear sky. The original and parent structure disappears, but a cell or seed is found to have been deposited capable of indefinite growth and development. The precise law which governs this curious process we do not pretend to have ascertained; but having discovered the fact, and availed ourselves of it in the cure of our unfortunate patients, we can afford to wait for the explanation.

It is now just twenty-six years since the discovery of a method by which surgical operations could be made without causing pain, an end which was attained only after many centuries of inquiry and experiment. We find evidence that this subject occupied the attention of surgeons from the commencement of the Christian era. The Roman physicians, in the first century, speak of the use of the wine of mandragora for the purpose of inducing sleep and insensibility when the knife or actual cautery were to be employed; and Pliny observes that some persons are put to sleep by the use of mandragora. Shakespeare more than once alludes to the sleep and inebriation which it induces. Hemlock, hemp, opium, and alcohol have been suggested, and at one time or another employed with unequal but rarely satisfactory results. Mesmerism and magnetism have had their pretended successes. Pressure and cold have been applied directly to the parts to be operated upon. Juvet recommended a ligature to be placed above the point where an amputation was to be made. Moore preferred pressure made more directly upon the nervous trunks supplying the diseased member. Richerand advised dipping the cutting instrument into hot water. Others, with the same purpose, have immersed the knife in sweet oil.

Weary of these fruitless experiments, surgeons had at length settled into the conviction that a sharp knife, with a light and dextrous hand, or, according to the old maxim, to cut "*tuto, cito, et jucunde*," were the only means we could ever hope to possess for alleviating the pains of an operation. In the edition of Velpeau's "Surgery," translated by Townsend, of this city, and ready for the press in December, 1844, occur the following passages: "To avoid pain in operations is a chimera that we can no longer pursue in our time. A cutting instrument and pain, in operative surgery, are two words which are never presented separately to the mind of the patient, but in an association which he must of necessity admit. . . It is to the hand of the operator and the quality of the bistoury that we must look to obtain the desired result. Let the hand be light and steady and the bistoury smooth and well sharpened, and give with the first stroke the whole length and depth that the incision should have, if you can do so without danger; then act with promptitude and without hesitation, . . and you will have no other pains to encounter than those which are inherent in the operation, and which nothing can separate from it." These words, my auditors, were the best legacy of comfort the most accomplished surgeon of the world could give to us, to avoid the pain of an operation, in December, 1844. The same month in which these words were uttered Dr. Horace Wells, a dentist of Hartford, Conn., made his first successful trials with nitrous oxide, and demonstrated that to avoid pain in surgical operations had ceased to be a chimera. There is, as I regard it, another singular coincidence connected with this discovery. The nervous aura which establishes an intercommunication of intelligence and sensation between the various members of the body, has been supposed to be identical with electricity. Anesthetics, in their power of causing temporary insensibility, indicate perhaps a control over the nervous electrical currents. In May, 1844, five months before the discovery of the anesthetic properties of nitrous oxide, the first message was carried over the telegraphic wire constructed by Morse, from Washington to Baltimore, in these words, very appropriately chosen by Miss Ellsworth of Hartford, Conn., "What hath God wrought?"

Electric cords had been laid which were ultimately to bind all the nations of the earth in one united system, establishing a universal and coincident sympathy throughout the human family. In the same year the electric cords of the individual man were in like manner brought into subjection, so that hereafter sensation, intelligence, and all communication between the different portions of the body could be interrupted or established at pleasure. The electric currents of the body and of the world were henceforth, by Divine permission, under the dominion of man. From the same humble

New England town a voice has answered to voice, as if in choral anthem, "What hath God wrought?"

"From harmony to harmony
Through all the compass of the notes it ran,
The diapason closing full in man."

The discovery of the anesthetic properties of nitrous oxide was followed in 1846 by the discovery of a similar property in sulphuric ether, by Drs. Jackson and Morton, of Boston. In 1847 Dr. Simpson, of Edinburgh, discovered that chloroform was a much more powerful anesthetic than either nitrous oxide or ether, but experience has shown that it is far less safe.

### The Defense of Paris---French and German Siege Artillery.

A military correspondent of the London *Times* supplies some interesting information as to the relative powers of the attack and the defense of Paris. He says:

The guns mounted on the forts of Paris are quite equal in power to any that the besiegers could bring opposite to them. If the German batteries were to bombard the city, it could only be after having reduced all the forts within easy range, otherwise the batteries firing against the city would be exposed to bombardment in their turn from permanent forts with bomb-proof cover at a comparatively short range. To reduce one fort might be an easy task if the fort stood alone; but each member of the encircling guardians of Paris supports, and is in its turn supported, by others, so that were one to fall no large force could march through the gap thus made without being exposed to the concentrated fire of many heavy guns, such guns as have never been used in war until now, if we except the isolated rounds fired from the *Affondatore* during the battle of Lissa.

The forts are armed with heavy ship guns, breech-loading all of them, made of cast iron, and strengthened by steel hoops round those portions of the piece most exposed to the shock of the explosion. The guns are rather untrustworthy in strength, but, under the present circumstances, there is time enough available to take any precautions that may be thought advisable. So far as is known, the gun of highest caliber now in Paris has a bore measuring not more than ten and a half inches across its diameter. The projectile weighs little short of 500 pounds, but a comparatively large charge cannot be used on account of the danger of bursting, unless the Russian plan of burying the piece in the earth be tried, as men say it has been lately. There are rumors of a wonderful new gun of huge dimensions found accidentally in Paris, and soon to be used against Versailles. There is no doubt that a gun can be made, and has been made in England, capable of such work.

The nearest approach to Versailles from the French side has been made by a gunboat, which has come close up to the bridge at Sevres. The distance, as the crow flies, is less than five miles—about 8,500 yards. English artillerists have not, with some exceptions, aimed at building guns for extraordinary ranges, yet 8,500 yards, the distance between the French gunboat and the royal quarters at Versailles, has been more than attained over and over again by English guns, and I believe lately by French guns from the forts. An experimental Armstrong 32-pounder, weighing only 26 cwt., with a charge of 6 lbs. and an elevation of 33 deg., sent its projectile 9,153 yards. The range was carefully measured. Mr. Whitworth states that his little 3-pounder, fired at Southport, attained a range of 9,688 yards. The long experimental 7-inch gun of six tuns, designed by Mr. Lynall Thomas, with 25 lbs. of powder, propelling a shot of 175 lbs., and fired with an elevation of 37½ degrees, ranged 10,075 yards. There have been several other instances of long ranges, and there would be more but for the general uselessness of firing at distances where no aim can possibly be taken.

The Prussians buy their heavy guns from Krupp, the great steel-maker of Essen; and instead of indiscreetly naming the pieces actually present before Paris, it will be better to state what guns Herr Krupp makes, and the Prussians may have here if they please and the roads allow. In the list are placed 13-inch, 12-inch, and 11-inch guns, but it would be deceptive to commence with them. Two of the 11-inch guns were made for experiment, and tried two years ago, for the Russian Government. The length of time required to make Krupp guns, and the certain knowledge that Prussian vessels of war hitherto carry nothing approaching these calibers, permit it to be said, without fear of error, that, except the monster gun shown at the Paris Exhibition in 1867, rather as a magnificent work in steel than as a gun for real service, there is nothing available for the siege of Paris more powerful than the 9·267-inch gun, a little heavier, but otherwise equal to the gun of the same caliber tried against the English 9-inch gun at Tegel, near Berlin, two years ago. The only novelties—already described in the German papers—are the so-called 50-pound rifled mortar, which throws a projectile of nearly 120 pounds, and a rifled howitzer, called a 25-pounder, and throwing a shell of nearly 65 pounds.

These facts fairly justify the conclusion that it is not by bombardment but by famine that Paris is likely to be reduced, and that not for reasons suggested by humanity, but because military wisdom so dictates. It has sometimes been remarked that the Germans have not shown the same extraordinary military talent in sieges as in battles. It should rather be said that in case of invasion by overwhelming forces the only check to the invader is to be found in fortresses, which cannot be outflanked, cannot run away, and detain for a considerable time a disproportionate number of the enemy.

### Applied Science Popularized.

We can find no better term than the above to express what we conceive to be the aim of that admirable journal, the SCIENTIFIC AMERICAN. Its success in achieving this end is as notable as the aim is legitimate and high. And whether as regards the end, or the "ways and means" of securing it, to name the SCIENTIFIC AMERICAN is to praise it. We are surprised, at each successive issue, at the versatility, freshness, and practical value of its table of contents. We know of no other journal which, in its chosen field (a very varied one in this instance), so nearly exhausts it in every new issue. And it is remarkable how completely it avoids repetition and triteness in doing this. Not less noticeable is it that in very few instances indeed does it publish anything of doubtful value, either in principle or application. On this account the SCIENTIFIC AMERICAN singularly enjoys the confidence and deference of both mechanics and inventors, and of the many able writers who address the public through the daily press. No paper of its class is so frequently quoted, and certainly the suggestions of no other come, *prima facie*, with more authority. In reading its ample, neat, and entertaining pages, from week to week, we are always at a loss what few articles out of the many to signally commend, by extract or reference, in our columns. Its elaborate articles—whether editorial or contributed—are always attractive, both for matter and manner; and as to its illustrations, our only cause of regret is, that we cannot transfer them along with the subject matter to our own columns.

That the SCIENTIFIC AMERICAN has a large and intelligent *clientage* (if that word may be thus adapted) is most apparent, from the frequency with which its readers contribute, by way of brief inquiry and suggestion, to its columns.

None but a paper of large circulation could, it is apparent, thus embrace in every issue the whole of a field so large and varied; and we are gratified to learn that the increase in the amount and variety of its contents is amply repaid in increased popularity and enlarged circulation. Its circulation now extends among all peoples who speak the English language—as its advertising patrons constantly learn, by letters of inquiry from the most distant and unexpected quarters.

The SCIENTIFIC AMERICAN announces its purpose to outdo itself the coming year. And, as if it were not enough to thus make itself attractive "for its own sake," it now offers to every person sending a club of ten subscribers a copy of Sartain's steel engraving (2x3 feet) of Schussell's celebrated portrait group, "Men of Progress." This composition (scene in the Hall of the U. S. Patent Office) embraces fifteen figures of inventors—among them Morse, Colt, Goodyear, Ericsson, Henry, and Hoe.—*Chicago Railway Review.*

### Another Motive Power.

The stone drilling machines in the Mont Cenis tunnel, as well as, we believe, in the Hoosac tunnel, are moved by compressed air, which, we are told, can be fed to, and used in, steam engines without difficulty. It is now proposed to bring into common use this motive power, compressed air, in several cities of this State, and in a very ingenious manner.

Some weeks ago a gentleman, who has undertaken this enterprise, visited Rochester, which has an important water power, with the object of using such of this force as now goes to waste, to accumulate a store of compressed air. By a very simple contrivance he believes himself able to use cheaply the power of the falling water to condense air, which is then to be drawn off into reservoirs, whence it is proposed to supply it, through large air-tight pipes, to machine shops and other places requiring motive power at a distance from the reservoirs.

If this plan succeeds at Rochester, it is said that an attempt will be made to utilize the immense force of the Niagara Falls to compress air, which is to be conducted to Buffalo, twenty miles distant, and there turned to account as a motor.

Some calculations which have been made induce the persons engaged in this novel enterprise to believe that the equivalent of a "horse-power," which costs, when steam is used, in this city, about $150 per annum, can be furnished by them at the reservoir of compressed air, for about $12. When it is conducted to a distance, the cost of maintaining conducting pipes would be an added element of cost; but this could not be very great.

The pressure of air needed, is, it is said, equivalent to about seven atmospheres. Of course, no fires will be used with this motive power; the danger of violent and destructive explosions will be at an end; air engines will be much more easily managed than those worked by steam; and if compressed air can be cheaply furnished in cities, it will become an immense convenience in many ways.

Its uses need not be confined, either, to places having falls of water at hand; on the seaboard the power evolved in the rise and fall of the tides could be utilized, to compress cylinders of air cheaply; and if the plan succeed at all, there appears to be no reason why steam should not be superseded, in New York, by air as a motive power; or why ships should not be loaded and unloaded, goods hoisted in warehouses, and the lifts in hotels and public buildings moved by means of compressed air.

### Geography of the Sea Bed.

At the meeting of the Royal Geographical Society, held on Nov. 20, a paper was read "On the Geography of the Sea Bed," by Capt. Sherard Osborn, R. N. The author gave an account of our present knowledge of the configuration of the bed of the ocean, as derived from Admiralty surveys and submarine telegraph expeditions during the last fifteen years. His explanations were illustrated by a number of diagrams showing sections of the North Atlantic and other oceans. It has been definitely ascertained that the greatest depth of the ocean does not reach 3,000 fathoms in any part where telegraphic lines have been laid. The bed of the North Atlantic consists of two valleys, the eastern extending from 10° to 30°, the western from 30° to 50° west longitude. The extreme depth of the eastern valley is under 13,000 feet, which is less than the altitude of Monte Rosa. This valley has been traced southward to the equator. It is separated from the western valley by a ridge in 30° west long., in which the average depth is only 1,600 fathoms. This ridge terminates to the north in Iceland, and southward at the Azores, so that it is volcanic in its character at both extremities. Its extreme breadth appears to be under 500 miles, and the Atlantic deepens from it on both sides. Explorations carried on in the Mediterranean, the Red Sea, and the Indian Ocean, showed similar uniformity in the level of the sea bottom; and the general conclusions arrived at by Capt. Osborn were that in the deep sea there is an absence of bare rock, and that there are no rough ridges, canons, or abrupt chasms. Moreover, that the bed of the deep sea is not affected by currents or streams, even by those of such magnitude as the Gulf Stream; but that it resembles the prairies or pampas of the American continent, and is everywhere covered with a sort of ooze or mud, the *debris* of the lower forms of organic life. In the course of the discussion, Professor Huxley said that, viewed on a great scale, there would be but slight difference between the large general features of the ocean bed and the dry land; but that the smaller features would be different, as the effects of denudation would not appear in the deep ocean bed. To the naturalist, the observations of the telegraphists were of great importance, as showing the existence of low forms of animal life in the deepest seas; and recent discoveries had shown that the most characteristic organisms of the deep-sea beds, named coccoliths and coccospheres, existed at all depths, even in shallow shore waters, and were also found fossil in sedimentary rocks of all epochs—a discovery of great interest, as confirming the view of the uniform conditions of submarine deposits in all ages of the earth's history. He was opposed to the view that the animals found living in the dark regions of the lowest sea depths depended for light upon the phosphorescence of some of the species, and saw no reason for concluding that they could not, like fungi, exist without light. He also doubted the accuracy of the very low temperatures said to have been found at great depths, and thought that those taken in the Indian Ocean might be explained by the fact that they were taken with thermometers not rectified for pressure.—*Nature.*

### The U. S. Signal Service.

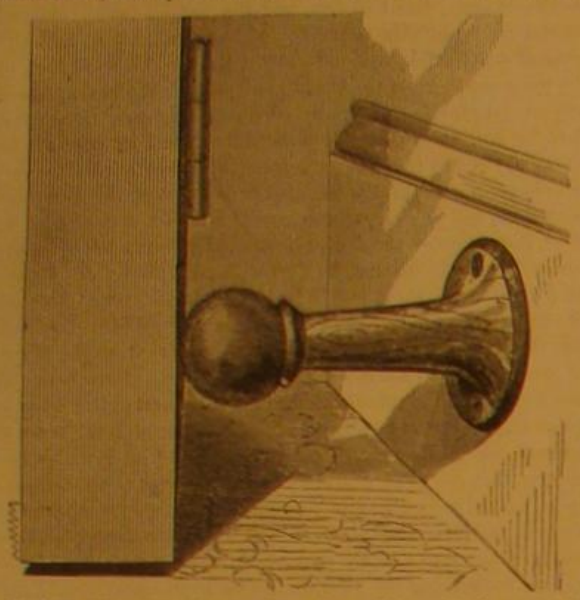
The post of Fort Whipple, Virginia, has been maintained during the past year as a school of instruction and practice in the duties of the signal service, at which such officers of the army and navy as might be designated for instructors in this branch of military duty, in their respective services, may themselves first receive a thorough knowledge of it. It has been an object also to maintain a nucleus for the service capable of being expanded upon any emergency. The equipments of the school for field practice have consisted of one section of a field telegraph train, complete in its appointments, eight telegraphic instruments and batteries, and the necessary testing apparatus for the instruction rooms, and the requisite sets of signal equipments for day and night signaling. The theoretical instruction comprehends the study of the army manual of signals, the cipher manual, and text-books of practical telegraphy, and discourses, together with oral instructions by the instructor. An inspection of the school on the 19th of March, 1870, by the Honorable Secretary of War, resulted in his expressed satisfaction with its management, and the authorization to increase the strength of the signal service detachment there stationed to the minimum of a company, to appoint the necessary non-commissioned officers for the detachment, and to erect such temporary structures as were necessary to increase the efficiency of the school and promote the comfort of the command. During the year thirty-eight officers have been under instruction at the school, thirty-one of whom belonged to the navy, four to the army, and three to the marine corps. Of these, thirty completed the full course of instruction, and were declared competent as acting signal officers and instructors. Of the officers of the navy instructed, twenty-three have been assigned to vessels of the navy now in service, to diffuse, as instructors in their turn, a knowledge of the signal service throughout the navy, and to so provide for the thorough co-operation of the land and naval forces whenever occasion may require. The officers of marines instructed have been in charge of similar instruction given in the corps of marines. Of the army officers who passed the course, two have been assigned to duty as instructors, one as assistant in this office, and the other temporarily as officer in charge of the signal service detachment. In addition to the officers instructed in the school, forty-one observer sergeants, intended for assignment in the division of telegrams and reports for the benefit of commerce, have received, within the year, the theoretical and practical instruction necessary to fit them for their duties. In the pressure of other duties, the experimental practice usually had at this school, for the improvement of the signal and military telegraphic apparatus, had been, to a great extent, suspended. The established drills have, however, been continued and improved. It is hoped that facilities may be given to provide, during the ensuing year, a field telegraph train, as a model, as perfect in all its parts as ingenuity and experiment can make it.—*Report of the Chief Signal Officer.*

BOXFORD, CONN., is a quaint old Puritan town—not a glass of ale sold in the place. It borders on eight towns, is eleven miles long, and six miles wide, and has a population of eight hundred and fifty souls, about the same as one hundred years ago. Appropriately enough, the chief industry of the town is the manufacture of boxes for shoes and matches.

## IMPROVED DOOR GUARD.

Our engraving illustrates a neat and useful door guard which is so simple in its construction and the use of which is so obvious, that it is, in connection with the engraving, scarcely necessary to describe it.

It consists of a stud screwed to the wash-board behind the door and tipped with a hollow elastic rubber ball or cushion, against which the door swings when opened, and which prevents noise, and prevents any injury to the door or to the



wall, from the concussion or from the striking of a key which may be left in the lock of the door.

Patented, through the Scientific American Patent Agency, May 17, 1870, by Charles William Gschwind, of whom further particulars may be had by addressing him at Port Republic, N. J.

### Defects in Locomotive Boilers.

It will be well to notice an objection constantly urged by those who believe in the excellence of the locomotive boiler, which may be thus stated:—"The boiler can only be uneconomical by wasting heat, but if it wastes heat, that heat will be found in the smoke-box; it will manifest its presence in the high temperature of the escaping gases. But there is not a high temperature of the smoke-box, therefore heat is not wasted." This is a very logical proposition, which breaks down only at the end. No one knows accurately what the temperature is in the smoke-box. So long as an engine is not heavily taxed and the draft is moderate, it is indisputable that the temperature, especially if the tubes be long and small, is low; and there can be no question that engines moderately loaded and running at low speed evaporate more water per pound of coal, provided combustion be perfect, than does an express engine careering across country at fifty miles an hour with ten or a dozen heavy carriages behind it. The boiler quickly falls off in efficiency as the quantity of coal burned increases, and this is no doubt one reason why the cost of transport increases so rapidly in proportion to the speed, albeit it is one which has not received half the attention it deserves. But to return to facts connected with smoke-box temperature: Stephenson's experiments made in the neighborhood of Derby, in 1843, showed that in the ordinary locomotives then in use the temperature in the smoke-box was great enough to drive zinc off in vapor; and this metal requires a temperature of not less than 800° to melt it. As a result of these experiments, Stephenson introduced his well-known "long boiler" locomotives, many of which are still running on the Great Eastern and other railways, with tubes nearly fourteen feet long. The evidence usually adduced in opposition to the idea that a high temperature exists in the smoke-box, is based on the fact that the black paint put on outside lasts a long time; but this is not good evidence, because, first, the inside of the box is always lined with a thick coat of soot, which is an admirable non-conductor; and, in the second place, the smoke-box plates are exposed to the action of a violent current of air, which increases in its effect with the speed of the engine. Besides this, there is little doubt but that the products of combustion operated upon by a powerful draft rush direct from the tubes to the chimney, and are, therefore, drawn away from the sides and front of the smoke-box, which is always some inches larger than the barrel of the boiler. The wonder is, considering the cooling effect of the external air, that the paint is ever burnt off a smoke-box at all. But it is none the less likely that the temperature within frequently reaches, or perhaps exceeds, 800°, or at least 450°, more than the water within the boiler. As the draft is dependent on the exhaust, and not on the temperature of the escaping gases, as in stationary boilers, there is no reason why the temperature in the smoke-box should exceed that in the boiler. The only method of even approximately obtaining that result as yet used by engineers, consists in lengthening the tubes; but this plan is always attended with the disadvantage of rendering a smaller blast pipe—and consequently an increased back pressure—necessary to maintain the draft. It remains to be seen whether other remedies may prove more effectual.—*The Engineer.*

### Collodion Balloons.

Collodion balloons may be made in the following manner: 6 grains of collodion cotton are dissolved in a mixture of 1 drachm of alcohol (sp. gr. ·835) and 2 drachms of ether (sp. gr. ·725) in a corked test tube. The solution is poured into a dry Florence flask, which is then turned about slowly, so that every part of its surface may be covered with the collodion, the excess of which is then allowed to drain back into the tube. Air is then blown into the flask through a long glass tube attached to the bellows, as long as any smell of ether is perceptible. A penknife blade is carefully inserted between the flask and the neck of the balloon, which is thus detached from the glass all round; a small piece of glass tubing is introduced for an inch or two into the neck of the balloon, so that the latter may cling round it. Through this tube air is drawn out by the mouth until half the balloon has left the side of the flask, and collapsed upon the other half. By carefully twisting the tube, the whole of the balloon may be detached and drawn out through the neck of the flask, when it must be quickly untwisted, distended by blowing through the tube, tied with a piece of silk, and suspended in the air to dry. The average weight of such balloons is two grains.

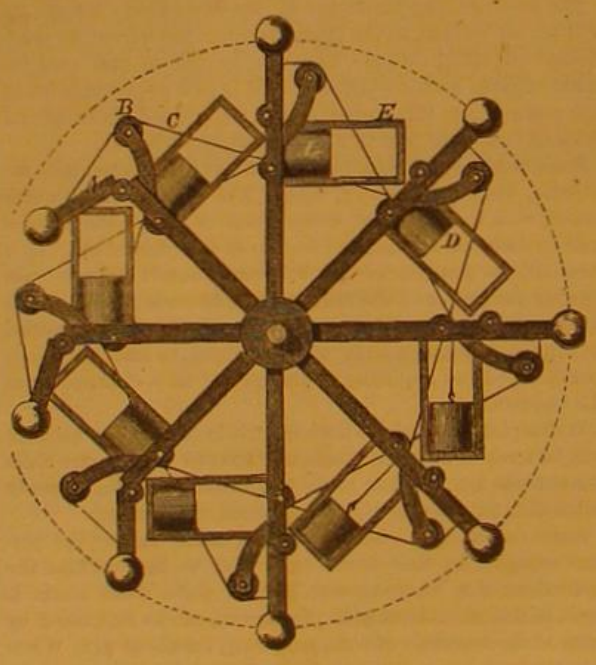
## PERPETUAL MOTION.

*NUMBER VIII.*

The celebrated astronomer, James Ferguson, F. R. S., devised the machine illustrated in Fig. 17. It is but fair to state, however, that the machine was designed to show the fallacy of perpetual motion schemes. Ferguson never believed it would move, but maintained that its immobility was a full demonstration of the utter impossibility of a self-moving device.

The axle is placed horizontally, and the spokes turn in a vertical position. The spokes are jointed, as shown, and to each of them is fixed a frame in which a weight, D, moves. When any spoke is in a horizontal position, the weight, D, in it, falls down, and pulls the weighted arm, A, of the then vertical spoke straight out, by means of a cord, C, going over the pulley, B, to the weight, D. But when these spokes come about to the left hand, their weights fall back and cease pulling, so that the spokes then bend at their joints and the balls at their ends come nearer the center on the left side. Now, says Ferguson, "as the balls or weights at the right hand side are farther from the center than they are on the left, it might be supposed that this machine would turn round perpetually. I have shown it to many who have declared it would; and yet for all that, whoever makes it, will find it to be only a mere balance. I leave them to find out the reason."

FIG. 17.

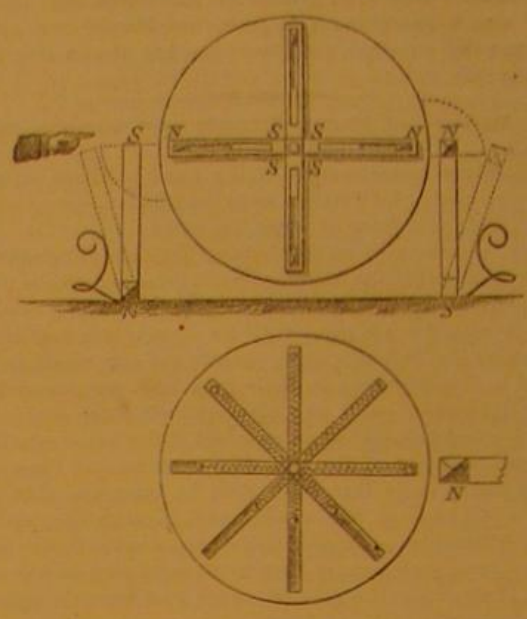



An old note informs us that "between the years 1760 and 1780, London abounded with perpetual motion seekers and their public exhibitions." Ferguson himself, a mechanician and inventor, would, no doubt, visit many of them, and would-no doubt, visit many of them, and would see "schemes ingenious, curious, and specious." He did not believe it possible to produce perpetual motion by any contrivance which required the motive power to be within itself (all external agents, such as that of a never-failing stream, the ever-varying pressure of the atmosphere, etc., being ignored); yet, notwithstanding that, in 1770 he devised this plan for perpetual motion. In his "Common Place Book," we find a fine pen-and-ink drawing of his scheme, which he designates as "the most rational scheme," but at the same time declares it to be "downright nonsense." Ar the conclusion of it he writes: "Whoever makes it will find that it is a mere balance;" from this, it may be inferred that the machine was never made—never having had any other existence than that on paper.

W. Stephen claims our notice for drawings which he has left us of his designs for perpetual motion through applications of magnetism, and also of capillary attraction, which we can, however, only treat as early misconceptions, and offer them as a warning against pursuing similar attempts; for it is evident that if such schemes as those were capable of proving anything, the proof could only relate to the perpetuity of the agent, and not of the mechanism sought. A feather retained in a constant current of air, would prove quite as much, that is, the constancy of the current as opposed to the inconstancy of the mechanical arrangement when rendered independent of such external agency. Stephen's sketches occur on the paper lining of the backs of a small quarto, entitled "Le Machine," by G. Branca, 1629, in the English Patent Office Library, having a fly-leaf inserted on which is written, "W. Stephen's Book, March 10th, 1799.

His first figure, Fig. 18, has the following written on one side of it: "Motion by Magnetism. W. S.—*Rep: per duobus N idem tempore quod cessit Attr: apud* ☞ *et sic aliter et de etc.*"

FIGS. 18 AND 19.




That is, the repulsion is twice through N in the same time that the attraction ceases at the ☞, and so on the contrary This notice is obscure enough, but the next, Fig. 19, marked "Magnets at the end of spiral springs," appears without comment; we can only surmise, therefore, that Stephen expected that the magnet, N, on attracting an opposite magnet, or steel bar, would overweight the wheel, and thus continually present one after the other in succession, in like manner, thereby causing a continuous rotation!

From the works of the Hon. Robert Boyle, Vol. V., page 71, we copy an historical account of a strangely self-moving liquor:

An ingenious teacher of mathematics, having occasion to make a composition for a new fire-engine, whereof he was to shew his Majesty a trial, mingled divers ingredients in an earthen pot over kindled coals; but could not or did not do it so warily, but that the matter took fire, and began to blaze furiously, which obliged him to stifle the blaze as hastily as he could; and having removed the vessel from the fire, and suffered it to grow cold, when afterwards he came to look upon it, to see if what remained might be of any use to him, he was surprised to find it variously and briskly moved. Wherefore, having set it aside, to be sure that it might be thoroughly cold, he, after some hours, visited it again, and found it move as before; and having cast store of seeds upon it, to see if the liquor would move them also, the bituminous part of it connected them into a kind of thick scum, that covered most of the superficies, but yet left some intervals, in which the liquor appeared, and discovered that it continued its motions. Two days after, the engineer discoursing with me of this fire-work, about which he had advised with me before, told me, among other things, of this odd accident. And when I asked him if the motion continued still, and had been answered affirmatively, though it was then a dark night and ill weather, my diffidence or my curiosity made me engage him to send for the pot as it was, partly to be sure of the matter of fact, and partly to try if the knowledge I had of the ingredients, which he had before told me, would afford any hint of the cause of so odd an effect; a like to which in kind, though not in degree, I had many years before devised, and successfully practiced, the way of producing.

The vessel being come, though the hasty transportation of it seemed to have sufficiently disturbed it, there did appear manifest signs of such a motion as the engineer had ascribed to it; and, therefore, he being willing to leave it with me, I caused it to be set aside in a laboratory, where some furnaces kept the air constantly warm, and did there and elsewhere, at different times, look heedfully upon it, now and then displacing or quite taking off some of the thick scum that too much covered the surface of it, and by this means I had the opportunity to take notice of several phenomena, whereof these are the chief:

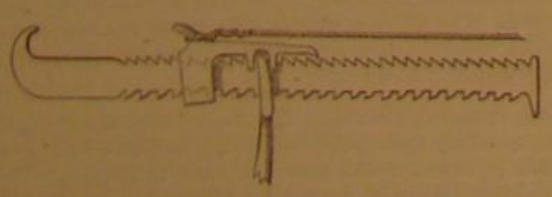
1. I observed that the motion of this liquor was not only brisk, but very various, so that having loosened some small portions of the scum, one of them would be carried towards the right hand for instance, and another towards the left, at the same time. 2. Where the liquor first came out from under the scum, it seemed to move the most briskly, flowing almost like a stream whose motion upwards had been checked and, as it were, reverberated by that incumbent obstacle. 3. Several motions in this liquor were the more easy to be observed, because, though it were dark, yet it was not uniform; consisting in part of oily and bituminous ingredients, which, though they seemed to have but one common superficies with the rest of the liquor, yet, but their colors and power of vigorously reflecting the light, they were easily enough distinguishable from the rest. And I often observed that some of these unctuous portions of the matter, emerging to the surface of the liquor, though perhaps at first one of them would not appear bigger than a pin's head, yet, in moving forwards, it would at the same time diffuse itself circularly, and make, as it were, a great halo, adorned with the colors of the rainbow, and so very vivid as afforded a very

pleasant, and at first surprising spectacle; these phantasms often nimbly succeeding one another, and lasting till they lost themselves against or under the thick scum. 4. The motions of this odd liquor were not only various, but frequently vortical; to be satisfied of which, I sometimes put short bits of straw, or fragments of some such like stuff, upon the discovered part of the surface of the liquor, by which they were carried towards very distant, if not opposite, parts of the vessel at the same time. But to make the vortical motion more evident, I several times detached considerably large pieces of the thick scum from the rest of the body, and had the pleasure to see them move both with a progressive motion in crooked lines, and with a motion about their own middlemost parts. All this while, the liquor, whose parts were thus briskly moved, was actually cold, as to sense. 5. To observe what the presence, or absence, of the free air would do to this liquor, I caused many spoonfuls of it, with some of the scum, to be put into a cylindrical glass, which, though large itself, had a neck belonging to it, that was but about the bigness of one's thumb, that it might be well stopped with a cork. But having, by this means, kept the free air from having a full and immediate contact with the whole surface of the mixture, as it had when that mixture lay in the wide-mouthed vessel, I could not perceive the liquor to move to and fro, no, not though the orifice of the neck were left open; whereas, having, at the same time, poured some of the liquor into a very shallow and wide-mouthed vessel, called in the shops a clear-caked glass, it moved rather more than less nimbly and variously than in the great earthen pot (which yet was of the same shape), and shewed us many of those vivid and self-dilating circles that have been mentioned in the third number; and these, by the fineness of their colours and the quickness wherewith they succeeded one another, afforded a delightful spectacle as long as I stayed to observe the liquor. 6. Though the motions of the hitherto mentioned liquor did not seem to be always equally brisk, yet they appeared to continue manifest and various in some diversities of weather, as to cold and heat, and when I looked on it by candle-light as well as by daylight; and when, not being well enough to visit it myself, I sent one purposely to look upon it, about ten o'clock at night, he brought me word that it continued to move as formerly, and so it has done for ten days; and how much longer it will continue to do so, time must determine.

POSTSCRIPT.—Some time after the foregoing account had been written, when I came to look upon the liquor (which in the mean time had been several times viewed, and appeared to retain its motions), I found, to my trouble, that somebody's impertinent curiosity and heedlessness had cracked the lower part of the earthen pot; at which overture, the liquor, though not the scum, was run out; which had put a period to our observations, but that, foreseeing that such an accident might happen, I had long before taken out some spoonfuls of the liquor, and kept it close stopped in a vial. By this means I had the opportunity to observe that, when I poured out the liquor into a wide-mouthed vessel, it would move as before, though this were done some weeks after it had been put up. And I remember that long after, having one day received the honour of a visit from a foreign minister, who was an inquisitive person and a man of letters, we chanced, among other things, to talk of the liquor; and though it were scarce to be hoped that it could retain any of its motive virtue, yet, to gratify his curiosity, and that of some ingenious men there present, I caused the vial to be brought, and having unstopped it, I poured out the liquor into a convenient-shaped vessel, in which, after we had suffered it to rest awhile, they were delightfully surprised to see it move (though not, in my opinion, quite so briskly as before), yet very manifestly and variously. This encouraged me to think it possible that it might retain some motion, though but languid, seven or eight weeks after; and therefore, on the 25th of July, I looked upon it again, and having caused it to be poured into a china cup, it manifested, at first, a brisk and various motion; but this, after awhile, did so slacken that I began to have some suspicion that the motion it was put into by effusion and the first contact of the air might have given it the greatest part of its agitation. But this being but suspicion, I put the vessel into divers postures in a window, the better to discover the true cause of this phenomenon; but whilst I was busy about this, which ingrossed my attention, a mischance overturned the cup, and, by throwing down the liquor, put an end to my speculation; yet this mischance hindered me but from observing how long the odd agitation of our liquor would have continued, but not from finding that it lasted a great while; for I shewed it to the foreign minister about or after the beginning of June, that is, about five months or more after the liquor was first observed to move.

## WIRE STRETCHER FOR FENCE BUILDING.

Much difficulty has been experienced in making wire trellises, vine frames, fences, etc., in properly stretching the wire. The simple instrument illustrated herewith, and which

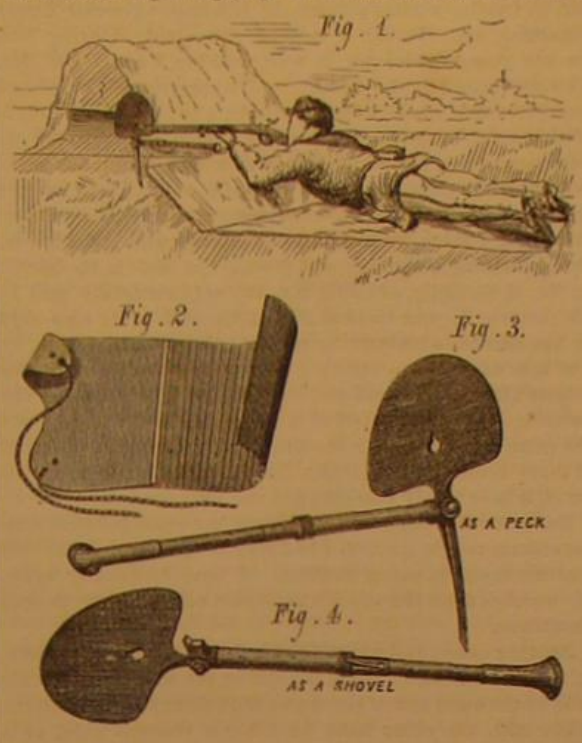


was invented and patented by William B. Hayden, of Columbus, Ohio, seems well adapted to this purpose. It consists of a hooked ratchet bar combined with a hooked sliding pawl, adapted to receive a hand lever by which it is worked, and by which the two hooks engaging the wire loops are made to approach and tighten the wire.

## INTRENCHING TOOL.

The tools which we now notice are the result of the growing improvement in musketry fire, and the consequent imperative demand for shelter. The new edition of the "Drill Book" contains provisions for the formation of such shelter pits and trenches, but no regular tools for general use are yet decided upon.

Captain A. Stewart Harrison, First London Engineers, has devised a combined spade and pick, which we illustrate in the annexed engraving (Fig. 4). It will be seen that the pick

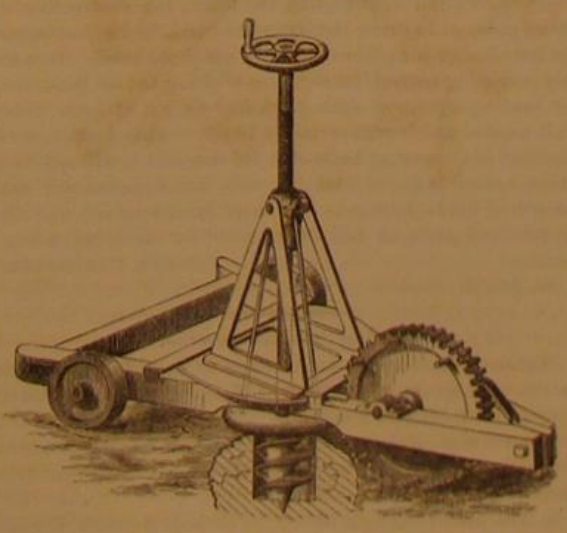



and spade are hinged at their junction, so that when the spade is in use the pick lies close to the handle of the tool, surrounded and secured by a telescope sheath. When the pick is to be used it is turned on the hinge till it and the spade are at right angles to the handle, in which position it is also secured by the telescopic sheath. The tool is also intended to serve as a mantlet in combination with the earth thrown up. This use is illustrated by Fig. 1.

Embrasures are prepared in the earthwork by building up in it, funnels made by rolling up the combined structure of wood strips and cloth, shown in Fig. 2, or made up of telescopic sections of zinc or thin iron, like a pocket drinking cup without a bottom. In rear of this funnel or embrasure is placed the spade, the pick being thrust into the ground. The spade is pierced with a circular hole, through which to fire, and, in fact, it plays on a small scale the part which the large iron-plated shields are intended to play at Gibraltar, Portsmouth, and elsewhere.—*Condensed from The Engineer.*

## POST-HOLE BORER.

In boring post holes by the ordinary hand-boring tool, they are apt to be sunk obliquely. In spacing the holes a measuring rod or tape-line is also necessary. The machine here-



with illustrated is intended to facilitate the spacing, and to secure the vertical descent of the auger. To this end the auger is made to keep its relative position with the surface by means of a strong guiding frame, fixed to the triangular frame of a carriage. The carriage is provided with a measuring wheel, which indicates the distance the carriage has rolled upon the surface, and thus secures uniformity in the spacing. Patented September, 1868, by A. F. Summers, of Peoria, Ill.

## Ten Thousand Mill Hands in Fall River.

"We'll Try," is the motto of the corporate seal of the City of Fall River, Massachusetts. The people have tried, and here are the figures of the new year, to show what they have accomplished. The factories represent a capital of $6,740,000, with 552,237 spindles, employ nearly 10,000 hands, and turn off about 133,000,000 yards of cloth per annum, while nearly all the territory within the city limits is thickly covered with tenements and a more elegant class of residences, the latter of which are chiefly in the northern portion of the city. The pioneers in the movement were Colonel Richard Borden and Bradford Durfee, the former of whom is still living, who many years since begun business with a limited capital in the Fall River Iron Company, and by industry and good management, they were enabled in the course of time, to begin the manufacture of "prints" in the establishments now bearing their names.

One element of success which has marked the city has been that its manufacturers, instead of investing their profits in other securities, have used them in increasing their manufactories, and the same holds true as to other business, and the immense capital which is wielded is strictly within the hands of the citizens. They have at various times met with reverses, in the way of conflagrations and strikes, but upon recovering from them, increased prosperity has been the result.

During the coming spring the Granite Company will construct a new building of stone, which will set in operation 40,000 spindles, and give employment to 400 people; the Durfee Company will build a similar building, for the same number of spindles; the Stafford Company one of 30,000 spindles, employing 300 people; the Merchants', an extension of 27,000 spindles; and the Wetamore Mills, of recent origin, construct a building of brick, just north of the Mechanics' Mill, with 25,000 spindles, giving employment to nearly 300.

## Antiquity of Pulpits.

The solemn reading of the law of Moses to the populace of Jerusalem must have been an impressive service, when "Ezra the scribe stood upon a pulpit of wood which they had made for the purpose." As to its configuration we are not informed, though it must have been a spacious raised platform if the six persons named on one side of Ezra and the seven on the other were also upon it. Stone pulpits existed in some cathedrals, churches, and monastic refectories, and one of iron is stated to be in the "Galilee" at Durham. Entries at Exeter, 1318–25, relate to materials "*pro la pulpytte*," but that was a distinct building on the north side of the church, for lectures and sermons. Capitals and bases for the ambos at Westminster were paid for in 1352. Preaching appears to have been a part of religious services from the earliest ages of the church; and the sermons were commonly delivered in the chancel in front of the altar. At a later time they were addressed from the ambo, or reading-desk, in the nave, an innovation assigned to Chrysostom at Constantinople. In some churches the preacher used to sit and the congregation to stand, and generally the lecture was more of the extempore kind than now prevails. The orderly conduct of a modern congregation arises from the discipline of ages, having succeeded, by gradual process, habits of comparatively little decorum, and the open expression of opinion on the merits of the preacher's discourse. The rarity of wooden pulpits of earlier date than the Reformation, is no doubt principally attributable to the sweeping clearance of church fittings pursuant of that event, just as with altars, and roods, and screens. Yet they, one and all, are met with in modern Papal churches, where the presence of either can scarcely be due to the Reformation.

## Liquorice.

Liquorice is a native of the south of Europe, and appears to have been cultivated in England since the time of Elizabeth. The chief places where it was long reared in any quantity for sale were Pontefract, in Yorkshire; Worksop, in Nottinghamshire; and Godalming, in Surrey. It is now, however, raised by many gardeners in the vicinity of London, by which the London market is supplied with roots in no respect inferior to those of warmer climates. It requires a deep sandy loam, trenched by the spade or plow to two feet or three feet deep, and manured if necessary. The plants are procured from old plantations, and consist of those side roots which have eyes or buds. The planting season is either October or February and March; the latter is preferable. The plants are dibbled in, in rows three feet apart. The plants do not rise above one foot the first season, and take three years before the root is fit for use. Decoctions of this root yield an extract containing a large quantity of saccharine matter and mucilage, with a little bitter extract. It is used in medicine under various forms, and is the black sugar or Spanish juice, so generally known. The liquorice roots are also used by brewers, to a considerable extent, in the manufacture of porter. Liquorice juice has been famed since the days of Hippocrates as useful in allaying thirst. Dr. Cullen supposes, however, that this property does not actually belong to the saccharine juice; but that if a piece of the root be chewed till all this juice is extracted, there remains a bitter which acts on the salivary glands, and this may contribute to remove thirst.

## SHOEMAKER'S TOOL.

A very handy tool, of which the accompanying engraving is a representation, is designed by the inventor, Mr. William T. Fisher, of Rome County, Tenn., for shoemakers' use. As will be seen it is a pair of pinchers or pliers having six instead of two jaws, all pivoted upon a single pivot, as shown, the extra jaws being provided with dies and punches for cutting holes for shoe strings and inserting eyelets therein

## Correspondence.

*The Editors are not responsible for the opinions expressed by their Correspondents.*

### The Law Applicable to Rejected Cases.

MESSRS. EDITORS:—On behalf of many oppressed inventors allow me through your excellent paper to suggest briefly how the present or new patent law may be construed so as to be consistent with itself and with justice, and also do honor to the Patent Office which is now in a muddle.

The meaning of the thirty-fifth section of the law depends upon the meaning given to the word "rejected," as used therein. But this section is construed and limited by a promise in section three, which says: "Provided also that all applications for patents pending at the time of the passage of this act, in cases where the duty has been paid, shall be proceeded with and acted on in the same manner as though filed after the passage thereof."

Now this promise covers all applications pending July 8, 1870, though such cases were also partially but not finally rejected, whether one claim out of forty had been rejected, or the whole case once or twice rejected by the primary examiner, or even rejected on appeal to the Board of Examiners-in-Chief, or to the Commissioner in person, provided the limit of appeal to court had not expired. All such cases were pending, though partly rejected, and they are not affected by sec. thirty-five. Thus the word "rejected" in sec. thirty-five most be limited to cases finally rejected and needing a special law to revive them.

The official decision of September 21, 1870, is correct in requiring a case to be amended or put in form for the next official action. But the proposed renewal, upon which the decision is made, is in itself an erroneous assumption, both by the applicant and the office. No renewal was required, for the case was not finally rejected. It was only partially rejected, and was yet a pending case, and could be prosecuted as such under sec. three of the law.

If the present official construction of the law be enforced, the rights of an inventor may be declared abandoned by only six months delay, a result too monstrous to be supposed in view of sec. thirty-two of the law and the time-honored right of two years prior to abandonment.

Therefore in my opinion the law as it now stands may be so construed as to be consistent with itself and with justice to all parties. Sec. one hundred and eleven protects all pending cases not fatally and finally rejected, and sec. thirty-five applies only to cases forfeited, withdrawn, finally rejected, or otherwise requiring revival under a special law.

DR. DANIEL BREED.

I have no doubt that the intention of the act of July 8, 1870, was, that after any action by the office, two full years should be allowed to the applicant to prepare for further action before his case was abandoned. CHAS. MASON.

[We have no doubt that whenever this question is adjudicated by the courts the judgment will be in conformity to the views above expressed.—EDS.

### Inspection of Stokers.

MESSRS. EDITORS:—In your article headed "Testing the Strength of Boilers by Steam Pressure," you alluded to an article of your Boston correspondent on the "Prohibition of Unsafe Boilers," and think he "might find a text for a sermon on the prohibition of ignorance and stupidity in those who are allowed to have anything to do with boilers or engines," and you conclude by giving a practical suggestion recommending a law appointing competent inspectors to examine not only the boilers, but the persons in charge of them, etc.

Now, Messrs. Editors, high as your Boston correspondent values your opinions on all scientific subjects, he is far from agreeing with your opinion as expressed in the article alluded to. He has no confidence in legislation on such subjects. He would not, if asked, name the boiler or even the species of boilers that should be termed safe and by law forced upon the users. He does not believe that competent inspectors can be appointed by any known legislative process. He does not believe in any test for competence prescribed by law. Nor does he believe it possible to lay down a rule applicable to all cases which would prevent steam boiler explosions. Vigilance, coolness, and a realization of the great responsibility assumed by the engine tender are the necessary qualities to insure safety in the use of steam with the old style of tank boiler. But where is the security? Temperance and knowledge are valuable in a fireman, but no security against accidents, nor will better pay insure better men. A common-school education is desirable in a fireman or engine tender, but not even a classical education would be a security against explosions. In truth there is no sure test of competence, and so-called competent men are generally the most reckless.

Your Boston correspondent: recognizing the fact that we have as yet scarcely commenced the use of steam for general purposes, knowing how nearly all of our public institutions are built over a volcano, controlled by a genie who may at any time get gin-y and hurl the whole fabric, be it court or school-house, church or bank, into the air, and dear valuable human beings into eternity; labors, and has for years labored, to make the use of steam as safe and harmless as possible, and to place the possibility of explosions beyond chance or accident. He wishes to impress all steam users with the conviction that, to use a boiler which, by ignorance, stupidity, or carelessness, or even by design, can be exploded, and kill and maim innocent persons, is a crime. He does not recommend any particular kind of boiler, but believes the introduction of safe boilers will elevate the standard of the men attending them, for the more perfect the machine the more intelligence will be required to attend the same. It must be remembered that carelessness or ignorance are far less compatible with the use of safe than with tank boilers, and the only difference is that in the one the penalty is stoppage and repairs, with plain and evident proof of carelessness, whereas in the other the result is generally a coroner's verdict of "no one to blame." BOSTON.

### Why Mainsprings Break.

MESSRS. EDITORS:—Having read in your valuable paper Mr. R. Cowles' remarks under the heading, "Popular Errors regarding the Watch," I became interested. Having had twenty years' experience in watchmaking, I agree with Mr. Cowles, excepting the breakage of mainsprings. In almost every instance where a spring breaks, a cause may be found, if the spring be carefully examined. Such has been my experience, at least, although I have seen springs broken without apparent cause, unless we charge it to high and uneven temper in the springs. A very large percentage of breakage is caused, I think, by handling the springs with moist hands, while cleaning and oiling, and placing the same in the barrel, as Mr. M. D. Kelly, of Cadiz, Ky., has very truthfully said in his remarks in your issue of Nov. 19th, 1870. He also says he has adopted a mainspring winder of his own invention, by the use of which a spring need not be touched with the fingers after it is cleaned and oiled ready for the barrel. The twisting of the spring out of a true circle in order to place the same in a barrel with the fingers is undoubtedly the cause of many breakages, and if Mr. Kelly's tool is what he claims for it, it is certainly valuable, and one long needed.

During twelve years that I followed my trade in Minnesota, experience taught me that I had four broken springs in cold weather to one in warm weather. I have frequently taken my watches from the window in severe cold weather, to save breakages.

Another cause, and one which I believe to be quite common, is, that in cleaning or oiling the spring, the watchmaker takes hold of the outer end of the spring with thumb and forefinger, while with the other hand he takes a chamois skin, or a piece of paper, and runs along to the center of the spring, at the same time straightening the spring at full length; he proceeds the same way in oiling, and this operation is the cause of many breakages.

I do not uncoil the spring, but place a narrow strip of chamois skin around it, and take hold of it at the side, with thumb and forefinger, holding it tight, and running it around the coils to the center and back; and then proceed to oil the spring in the same way, after placing a drop of oil on a clean piece of chamois skin; I thereby avoid a severe strain to the spring by bending it in opposite directions, as is too often done. I then place it in the barrel clean and free from dust. With Mr. Kelly's mainspring winder nine out of ten springs, which would otherwise be broken will, I believe, remain sound.

Great care must be taken to keep springs clean and dry from the perspiration of the hands. With all due deference to Mr. Henry Holinshed, Jr., of Camden, N. J., in his comments on the mainspring, in your issue of Dec. 10, 1870, I must still take some exceptions. He says when a mainspring is taken out in cleaning a watch and is handled by the watchmaker, that the warmth of the hands expands the spring to such an extent that in placing it in the watch and winding it up to its full power, the spring then, being in an expanded state and wound tight around the arbor, the contraction will be so great as to cause the spring to break. His hands must be very hot or his philosophy will not hold good. To prove his reasoning correct, he says one wishing to test it can do so by heating a piece of spring and fastening it at both ends at full length, and it will certainly break. This last cannot be doubted if the spring be heated red hot, but it will not break when heated to blood heat. I wish, for experiment's sake, he would hold a spring in his hand for 24 hours, and then fasten both ends at full length, and let us know when it breaks. LAUREN CARPENTER.

St. Joseph, Mich.

### Solar Motive Force.

MESSRS. EDITORS:—The attention of inventors is directed to this field by the proposition of Ericsson to develop an engine to act from direct sunlight.

There are several typical ways of securing a useful motive power from sunlight, and their practical utility depends on their economy and adaptability.

1. The use of sunlight direct. This is that which Ericsson proposes to employ. It involves the use of an engine and of a concentrating apparatus; and has its limitations in the cost of construction and the care and expense of keeping in order, with the limitation of power in specific spaces, and confinement to the time of sunshine, etc.

2. Use of the variations of heat between day and night. This has less limitations, but still requires a costly engine of considerable magnitude.

3. Use of sunlight through organic products. This may be either by burning, as in steam power, where the whole product (recent or fossil) is used, to gain a small per cent of the force, or by use of a small proportion of the product, as animal food, to produce animal force, gaining a high per cent of power from the part so used as food. This involves the use of a large and suitable surface of soil, with labor and preparation long before use, and requires costly engines; that is, animals. But it has the advantage of complete control over the amount of power desired, and the time and place of its employment. It is the mode by which the greater portion of motive power is secured, the natural result of its controllable availability.

4. The cheapest and most simple of all the modes of procuring motive power from sunlight continually thrown upon the earth is to take advantage of the masses of matter set in motion by it; namely, wind and of water. Both are entirely practical, and easily made available. They have been in use from the earliest times, and admit of great concentration for use.

Water powers are more limited in position, but more regular and controllable; are suited to great and small works, and are of great practical value.

Wind powers are cheap, simple, and nearly everywhere available; not limited to sunshine, although limited by their variability. They are a mode of power of great use and value. But they yet lack much to make their use suit the American mind.

It is probable that wind power is a more worthy field for high inventive talent than "sun engines," viewed in any practical light whatever. S. J. WALLACE.

Keokuk, Iowa.

### Man Not Made of Clay.

MESSRS. EDITORS:—In the third lecture of Dr. Doremus, before the Young Men's Christian Association, as published in the SCIENTIFIC AMERICAN of January 1, current volume, while discoursing on the properties of clay, the learned doctor says: "In the Bible it was stated that men were made of clay; but it might be said in passing that the metal which formed the basis of that substance was almost the only one not found by chemists in the human frame. Doubtless the Biblical reading ought to be earth."

The doctor here has made a grave mistake, which, for the cause of truth, I think ought to be corrected. The Bible nowhere states that men were made of clay. The history of creation as contained in the Book of Genesis informs us that one man, Adam, was formed of dust—see Genesis, chap. 2-7: "And the Lord God formed man of the dust of the ground and breathed into his nostrils the breath of life; and man became a living soul." Again, chap. 3-19: "In the sweat of thy face shalt thou eat bread, till thou return unto the ground; for out of it wast thou taken; for dust thou art and unto dust shalt thou return." Gen., chap. 2-19: "And out of the ground the Lord God formed every beast of the field and every fowl of the air."

The word clay is not found in connection with the history of creation, either of man or beast; no need therefore in this case for a new translation in order to reconcile God with science.

As this lecture was particularly addressed to a very respectable Christian association, and will doubtless be widely published, it is due to Christianity that the Doctor's mistake be publicly corrected. EDWARD SELLON.

Galva, Ill.

### A Fine Testimonial.

MESSRS. EDITORS:—Inclosed please find the names of fifty-three subscribers, together with $132·50, the amount of their subscriptions.

I started for a club of ten, but that was obtained in almost an hour. I thought that I might work it up to two clubs. I did so easily; went for another. I got that, and so on, until I have got five clubs and over. I think I could get more if I had the time.

Although I have had your paper for the last ten or fifteen years, it has for the past year been more appreciated by all the members of the family than heretofore. My wife reads it as much as I do, and with as much relish as myself, and my boy, only six years old, got so much interested in it that on Thursdays, when I come home with your paper in my hand, he would ask: "Pa, is that the SCIENTIFIC AMERICAN?' "Yes," I would say. "Come," he would say, his eyes brightening up, "read to me and tell me all about the bugs." For him I will say, "don't forget the 'bugs' another year."

Ilion, N. Y. GEO. S. KNIGHT.

### Men of Progress.

MESSRS. EDITORS:—The engraving came through all right, for which please accept my thanks. I am amply repaid for the pains I have taken to keep my club alive during the past ten years.

The picture is a beautiful one, and much admired by all who have seen it here. I should have placed Ericsson in the foreground with a *Monitor* near him. What an immense amount of destruction the rebel *Merrimac* would have done had it not met the stripling with his sling. So I say, all honor to the inventor of the *Monitor*, and, though a foreigner, we might well adopt him as a true American inventor.

Haverhill, Mass. N. SPOFFORD.

[We shall still continue to give this superb work of art to all those who send us a club of ten subscribers.—EDS.

### Rain-water Cistern.

MESSRS. EDITORS:—There is no better filter for a rain-water cistern than a well of soft-burned bricks built up within it. I have one twenty inches square in the center of my cistern, from which the pump draws. It may be built in one corner as well. The water percolates through the substance of the bricks, which detain every impurity, except such as are chemically united with the water.

ENGINEERING IN INDIA.—The Anglo-Indian Government is now spending upon public works $38,500,000 a year, a sum rather in excess of the entire revenue of Belgium. It is found that officers of the royal engineers are not altogether suitable for India, and the Duke of Argyll, Secretary for India, has now established a special college to turn out the article required. It will be remembered that not long since the Government of India called in the assistance of American engineers whose experience in rough-and-ready, yet difficult work, was thought to be that most needed in India.

Special Correspondence of the Scientific American.

## AN IDLE DAY AT FALL RIVER, MASS.

Leaving New York in the afternoon on board one of the magnificent steamers for Boston, I arrived about five o'clock next morning at Fall River. Startled by the barbarous sound of a gong from a feverish sleep on a cold winter morning, I felt for some time undecided whether to rise and continue my journey on the early train for Boston, or wait for a later train. After a careful canvass, the bed seemed to have a majority of votes, and I turned over for another two hours sleep regardless of gong, knocking at the doors, and all other appeals. I heard at last the bell of the locomotive and the rapidly increasing puffs of the exhaust told me the train was off.

I expected to sleep, but was rudely disappointed, for no sooner had the train left than it seemed a thousand fiends had been set loose. What with the blowing off of boilers, the hurrying forward and backward of, it seemed, hundreds of trucks, the shouts of human voices and the shrieking of locomotive whistles, sleep was impossible, and after several vain attempts, I rose, and having plenty of time, started to see how a manufacturing city looks on a gray, cold, wintery morning.

Fall River is so situated that the casual traveler through it, particularly in the early morning, could never suspect it of being the American Manchester. The depot, alongside of which the steamers land, is situated in one corner of the city, and under the hill on which it was built; and the railroad on the same level skirts only the edge, and soon leaves Fall River in its rear. The only signs of life at this hour are the columns of smoke issuing from a number of tall chimneys, where the giants, who are expected to do all the heavy work the day, have already commenced their morning meals. The first objects in sight, on leaving the depot, are the magnificent buildings of the "American Print Works." Nothing in this country or in Europe surpasses them in simplicity and purity of design, nor in the massive durability of their construction. I have seen and duly admired the celebrated works at Mulhouse, in France, as well as the magnificent works of Sir Titus Salt, at Saltaire, in England, yet neither can compare with the American Print Works in design or construction.

Crossing a pond of water on a long wooden bridge, I had before me the extensive works of the "American Linen Company," which is used as a cotton mill. It is one of the largest in Fall River, running 82,500 spindles, 2,000 looms, employing 1,200 hands, and manufacturing twenty millions yards of cloth per year. Five powerful engines, 32 inches by 5 feet stroke, drive the machinery, and over 7,000 tuns of coal per annum are consumed in the furnaces of their sixteen boilers. Turning up the hill on which Fall River is situated, we pass one mill after another, all built in the most substantial manner, out of native granite. In fact, everything is solid and substantial. Even the inhabitants partake of this solidity; for we believe that the original settlers averaged more in hight and weight than those of any other place we are acquainted with.

No casual observer could believe that Fall River is built along the course of a stream—first, because it is built on a steep hill, or bluff; and second, because no water course is in sight. The original name of the stream was "Quequechan," and it is the outlet of Watuppa Pond. This stream has a fall of 130 feet, in less than 2,500 feet horizontal measurement, and most of the mills are built over it, so that the water is used, over and over, to give the power required. Most of the new mills are built regardless of the stream, and run entirely by steam; yet, until the erection of the last—the Mechanics' Mill—were built on the high level, near the pond.

In 1860, Fall River produced 45,225,000 yards of cloth, and consumed 10,167,000 pounds of cotton. Last year the production was 132,865,000 yards, consuming 25,253,000 pounds of cotton; an increase of nearly two hundred per cent in ten years. Organizations have been perfected for the erection this year of five new mills, averaging 30,000 spindles each. With these additions, Fall River will contain twenty-six first-class cotton mills, running over 700,000 spindles. When we add to these the large print works, iron-rolling mill, foundries, machine shops, and other incidental works, an idea may be formed of the future of this great beehive of American industry. Yet the whole of the present city may be said to have been built since 1843, for in that year nearly the whole was destroyed by fire.

Nearly all the mills are owned in Fall River, and are under the personal management of the owners. They have adopted the motto, "We'll Try," for the city seal, and carry this sentiment into every department of their works. They are young, and have their history to make, and are working with energy and judgment to make it the proudest of all manufacturing cities. The location is healthy, and the harbor deep and secure—being part of the beautiful Narragansett Bay—and they are, for all practical purposes, as near New York as Brooklyn or Jersey City.

Concluding that an idle day might be profitably spent in this place, I retraced my steps down the hill to the front door of the American Print Works. In the tower, which forms the vestibule, I found a doorkeeper such as it would be difficult to duplicate. He was neither polite nor rude. Like the solid granite of the tower, he was emphatically the right man in the right place. He knew his duty, and he did it. "Go to the office and get a ticket, and you can go in." I went and got the ticket, and got in; and when in, to my great delight, found myself at liberty to go where I chose. Whenever I found myself "cornered," I found a ready answer to my questions, short and to the point; and, although I frequently lost myself in a labyrinth of courts, rooms, and passages, with occasional assistance I found my way through all but the blind regions of the dye-house, where any one used to London fogs would be unable to get about, unless accustomed to its queer ways. And here let me call the attention of the readers of the SCIENTIFIC AMERICAN, who have any theory on the subject of ventilation, to the fact that a dye-house is the place to experiment, and either establish the truth or fallacy of their theory. No place needs ventilation more, nor is there a more profitable field open for the application of ventilating appliances. Having made myself familiar with the Works, I will now lead the reader through it, and explain to him the different manipulations.

This establishment was started some thirty-six years ago, and has, during that time, established for itself an enviable reputation. There is not a family in the whole of this broad land that is not aware of the excellence of the goods sold as American prints; and whether we enter the palatial stores on Broadway, New York, or the little roadside store on our frontiers, the prints of the American Print Works are certain to be the admiration of the lady customers. Yet these works passed through a fiery ordeal on Sunday, December 15, 1867, on which day they caught fire from some unknown cause, and nearly the whole establishment, with two new wings, just completed, was destroyed, involving a loss of nearly two million dollars. On Monday morning over three hundred men were at work clearing away the rubbish; and, as rapidly as a corner were cleared to the foundation, the erection of the present stately edifice were commenced. In sixteen months from the date of the fire, the whole of this immense pile was, not only completed, but filled with machinery.

It is perfectly marvelous to examine the whole of this establishment in all its multitude of details, and find that, no matter how insignificant in itself, a practical and inventive mind has carefully studied every part. Whether the visitor be an engineer, architect, founderyman, or carpenter, he will continually find details new in themselves, and most happily applied. To a calico printer, the works are a marvel of compactness. Much credit is due to the designer of the establishment as well as to the capitalist, who, confiding in his sound judgment, left him free to carry out his designs. The whole of the works, with all the ells and wings, present a frontage of 2,055 feet of solid granite masonry, built after the most appropriate architectural design, giving at a glance the impression that money was neither stinted nor wasted in its erection.

Entering the tower with the magic ticket, I ascended the massive stairs to the top of the building, and found myself in a large "hanging-room," where damp cloth is air dried before being used. On the north end of this floor is the "designing room." A tap at the door, a cheerful "come in," and I open the door to behold a room about forty feet wide by eighty feet in length. Before each window is a peculiar kind of desk, and at each desk a gentleman and an artist sits engaged on some new design to be printed on calico.

This designing is a peculiar art, and requires a good deal of taste and judgment, particularly those designs which cover breadth: for, besides the production of original figures in which the colors are harmoniously blended, they must be so arranged that different breadths will easily fit the figures without waste, and, yet so that particular designs may not "run"—that is, not form continuous lines, but be lost as often as possible, to avoid geometrical forms, which give an appearance of stiffness to the design. A peculiar feature in this room is the extensive library of designs pasted into large books, and filling one whole side of the room. It contains samples of prints of all countries. One of the cases contains all the samples of prints designed in their works—very curious to examine. The first book contains many curious patterns, printed partly on rolls and partly blocked in by hand; some have only one or two colors painted in by hand. An idea may be formed of the progress made in this kind of work when we state that it took six years to fill the first book of samples, and that the last book was filled in nine months. After the design is completed and approved, it is enlarged nine times in the "dark room" on the principle of the magic lantern. The design being placed on a glass plate throws a shadow on a table nine times as far below the glass as the light is above, and the outlines being traced, the design is finished more accurately with ink, and the different colors separately drawn. The next step is the engraving of the rolls; this is done by ladies in the pentagraph room. Hundreds of the most skilled engravers would be required to do the work which is here accomplished by ten machines, each conducted by a lady, who, tracing the design, operates a number of diamonds, which trace the design reduced one tenth in size on the copper rolls. The finely-built machines, the highly-polished copper rolls, and pretty women, make this room very attractive for visitors, but dangerous for bachelors. Even I, although not a bachelor, lingered longer over the designs in this room than in the designing room, where they were more brilliant in color. Most of the designs have a groundwork of lines which is traced by a separate machine, and is always at an angle with the axis of the roll; this is done to prevent the "doctor," or scraper, from entering into them when in the machine.

The printing room is, although not the largest, the finest and best arranged in the world. It has room for twenty machines, sixteen of which are in constant use. This floor is eighty feet deep, part of which is taken up by the "hot rooms." It is magnificently lighted, both by the large windows on the first floor and by those of the second story through a large opening, surrounded by a handsome railing.

The newly-printed goods, instead of, as usual, passing directly into the hot room, pass over a series of flat steam chests, where a large amount of moisture is evaporated, and the color is set in an atmosphere more fully charged with oxygen than that of the hot room. There is obtained in this way a more perfect oxidation of the mineral colors, and consequently a more brilliant effect. This room is the admiration of all printers that visit the works, and the printers attending the machines are a fair type of American mechanics.

The kier room, with its fourteen kiers and washing machines, are worth a visit. All the kiers are high pressure, and work on the Barlow principle. Two of these have been lately changed, and are now worked separate on an entirely new principle by which the time of bleaching is reduced one third, and the goods are much better than those made in England. This is an American invention, and is applicable to all kinds of kiers.

After the goods have passed through numerous processes they reach the folding room, in which they pass first through a number of "conditioning" or "damping frames." They pass, for the last time, through the drying machines, which here perform the same office as the mangle in domestic laundries; they are then ready to be folded. This, although it seems simple, is a difficult operation, for the goods must be all folded exactly one yard to the fold, and also the edge must be kept perfectly even. Many print works fold by hand, and as women and girls are employed, it is really a barbarous kind of work, involving physical exertion more laborious than should be performed by a woman. Thanks to American ingenuity, folding machines are now made so perfect that the women have only to guide the cloth, and all the hand labor is performed by the machine.

The present works are built as nearly as possible fire-proof. All the wings and buildings are built entirely surrounded by heavy walls, and all communications can be instantly closed by two iron doors to each opening. A great number of fire escapes are erected on the outside, communicating with all the floors, and all parts of the works. On each floor are also two fire plugs placed on the balconies of the fire escapes, two of the largest size duplex steam pumps are placed in the fire-pump room, and all kinds of apparatus that may be required are placed ready, and kept in perfect order for instant use. There are also large force pumps attached to a 40-horse power water wheel, which can be started, should steam chance to be wanting. Sixty powerful streams of water can thus at any time be thrown on different parts of the works. No engineer should neglect to examine the boiler house, the best arranged in America. It contains twenty-two boilers in constant operation. The whole arrangement is perfect itself. The boilers are each fitted with gongs, etc., the same as those used on the boilers of the Beach Pneumatic Transit Co. under Broadway, while the partitions between the boilers, instead of being built of brick-work, are composed of tubes in which water is made to circulate. The foreman assured us that no matter how suddenly the works will draw upon steam, which in print works is at times nearly all that can be supplied, in ten minutes he can recover the pressure by opening the draft.

Speaking of draft, brings me again to the chimney which first arrested my attention in the morning. This chimney is the finest in America, when harmonious architectural effect is considered. It is built on new, but well-tested principles, the invention of a well-known American engineer, who has built a number of them in the Eastern States. It insures an equal draft by maintaining a uniform temperature. This is accomplished by a hot chamber, not unlike the Siemen's regenerators. The friction is also diminished as much as possible by the form of the flues. An attempt was recently made to place an automatic damper in this chimney, which it seems was not evenly balanced; on closing the flue it tore away from its fastenings. Thus released it commenced turning with great velocity. All attempts to grasp it with large pipe tongs proved unavailing, and only the opening of the large door in the chimney could stop it.

It is a matter of congratulation that scientific engineers are taking hold of the erection of factory chimneys, for there are few things which cause so much annoyance, and interfere so much with the proper success of technical operations as poor chimneys, not to speak of the waste of fuel attending their use.

Having spent so much pleasant and profitable time in the works, I passed again through the tower, and bidding the brusque door-keeper good-afternoon, reluctantly started for the Old Colony railroad station in time for the 3:40 P.M. train for Boston. The last sight that met my eyes as I left the station was the smoke gracefully floating from the top of the chimney one hundred and thirty feet from the ground, as I whirled along the shore of the now ice-bound Mont Hope Bay, a part of which was in sight until I reached Taunton.

### Sawdust in the Smith-Shop.

A correspondent of the *Coachmaker's Magazine* writes:

"Sawdust is a grease neutralizer, and annihilator, and a file saver. No well-regulated smith shop should be without a well-filled box of sawdust at each drilling machine. The box should be large enough to place the rim, when it is drilled, inside. Give the iron a thorough rubbing with the sawdust, which, from its great power of absorption, will remove all the grease or oil, or so nearly so that but a light rubbing with waste is necessary to make the iron quite clean. This rule applies to the screwing and nutting of clips and bolts, or to other purposes where oil is used about iron. Oak or ash sawdust is the best. Pine sawdust has greater absorptive power, but leaves a resinous surface on the iron that is more destructive to the file than iron. My average weekly consumption for twenty-five files, using eight drills, is about three bushels per week."

### Improved Sewing Machine Cover.

The sewing machine covers employed previous to the introduction of the improvement which forms the subject of the present article, and represented in the annexed engravings, have been liable to warp and crack, and from these causes have not proved as durable as desired. The improved cover shown in the engravings obviates this difficulty, and, as we are informed, it can be manufactured even more cheaply than the former inferior ones, it meets with great favor. A very large number, we are informed, are daily turned out from the factory of the proprietors.

A peculiar advantage besides those already enumerated, is that the materialof which the cover is made can be used without long preparatory seasoning. The reason will appear when we state that it is made wholly of veneers, cut thin and glued together in a press, which gives the proper form to the box.

Fig. 1

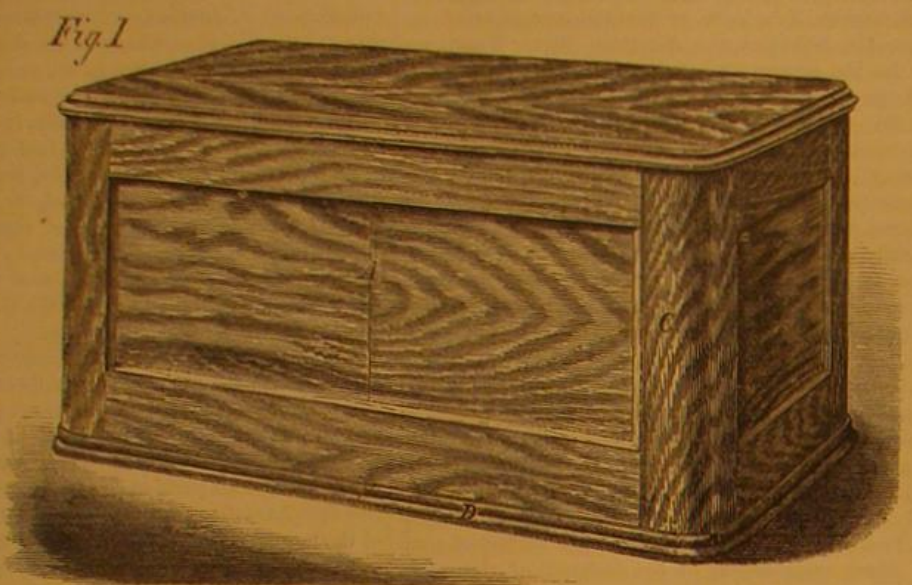
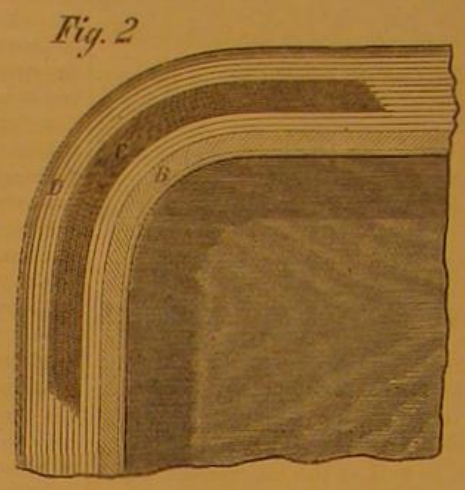


Fig. 2



FRENCH'S IMPROVED SEWING MACHINE COVER.

The corners are rounded, as shown in perspective, Fig. 1, and the sides of the box are formed of one continuous hoop, joined at A. There are no joints at the corners, and no dovetailing is required.

Fig. 2 is a full sized view of the lower edge of the box at one of the corners. B is a layer of white-wood veneers glued together, the grain of which is at right angles with the grain of the veneers which line it, as well as those which cover it on the outside. The grain of the latter runs longitudinally around the box, while the grain of the white-wood stratum is vertical.

The grain of the vertical corner pieces, C, is also vertical. The grain of the horizontal pieces which, with the vertical corner pieces, C, inclose the panels, is longitudinal.

The top is made also of veneers glued together, as is also the bead or molding, D, which ornaments the bottom. The result of this construction is a box of elegant appearance, and of such resistant power to contraction and expansion from heat, that one shown us, and from which our engraving was made, said to have been baked in an oven at 212° Fah., presents the appearance shown in Fig. 1. It has not opened anywhere except in an almost imperceptible crack in the outside veneer of one of the panels, and only a very slight springing is perceptible in one of the lower edges.

This improvement was patented June 7, 1870, by Evelyn F. French, of whom information concerning the purchase of rights or orders for the article may be had, 340 Seventh avenue, New York city.

### Improved Method of Attaching and Lubricating Car Wheels.

This invention is especially designed for coal cars in mines, the mode of lubricating the axles of such cars having been hitherto very imperfect, the oil having been allowed to escape from the axle, leaving it so dry as to greatly increase the friction, and to cause cutting of the metallic bearing surfaces unless frequently oiled, the waste of oil being great, and the work expended in propelling the cars being also notably increased.

If the oil be supposed to remain in the wheel until it has been run into the mine, where the wheel comes in contact with water, the water will get into the hub, and replace the oil, and cutting will soon commence, especially if the water be charged with sulphur or sulphureted hydrogen gas, as in this case mechanical attrition is aided by chemical action.

Also in the process of loading the cars the dirt or dust falls between the collar and the hub, intruding between the bearing surfaces and greatly increasing the mischief.

It is claimed that all these defects are overcome by the device illustrated in the accompanying engravings, in which Fig. 1 is a sectional view, the section being made through the center of the hub and oil chamber, and Fig. 2 a perspective view of the entire wheel and attachment.

Fig. 1

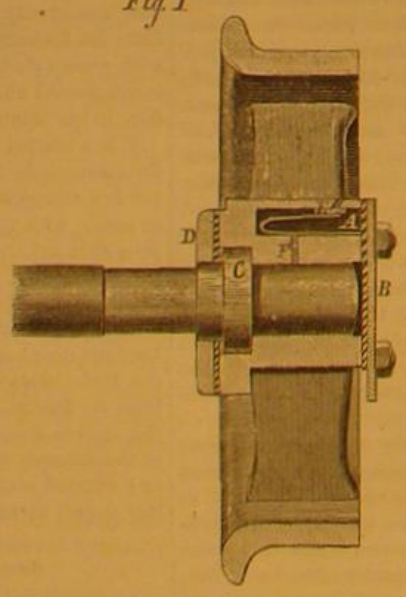
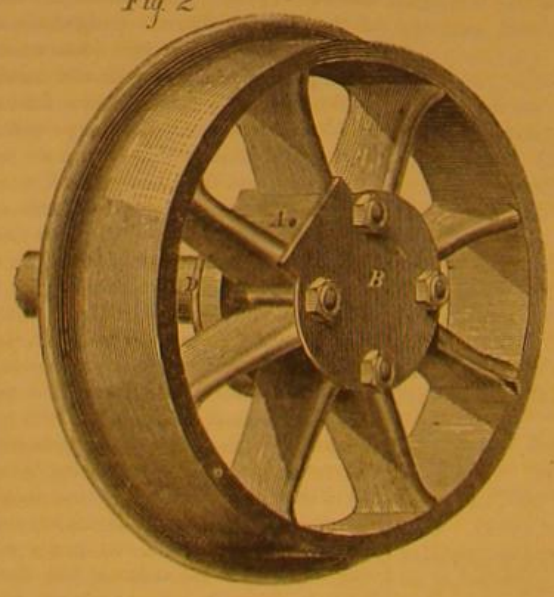


Fig. 2



REECE'S ATTACHMENT AND LUBRICATING DEVICE FOR CAR WHEELS.

Between two of the spokes of the wheel and adjoining the hub, there is formed a chamber, A, Fig. 2, in which the oil is placed. The chamber is open at one end, and is cast with the wheel. The open end of this chamber is closed with a plate, B, which is bolted firmly to the end of the oil chamber and hub as shown.

A recess in the hub receives the collar, C, of the axle; this collar and the inner plate, D, securing the wheel on the axle when the bolts are inserted as shown in Fig. 1.

Both the outer and inner plates are made tight with gum packing, and the external aperture for the admission of oil to the oil chamber is closed with a spring valve, E, except when in filling the latter is pressed down with a rod of wire. An opening, F, leading from the oil chamber to the inside of the hub supplies the bearing surfaces with oil.

It is claimed that this arrangement excludes water and dust, and that the chamber needs to have its supply renewed only at long intervals. The oil is not allowed to flow so copiously upon the axle as to pass out through the inner plate around the axle, but is supplied gradually as required.

Patented, through the Scientific American Patent Agency February 13, 1866, by William R. Reece, of Tremont, Pa., whom address for further information.

### Damp Buildings.

Damp, when it enters a house, says Dr. F. R. Smith, comes in at the roof, at the doors and windows, through the walls, from the ground, or through leaking of pipes. The entrance of damp through the roof itself is fortunately so unpleasantly conspicuous, owing to its staining the ceilings, that it is not long in being found out, and before repairs more or less complete are made. But for this, roofs would be more commonly untrustworthy than they are, and injury to health and life would oftener occur through their failure. Many roofs are, however, so constructed that in times of great rain and of snow, an inundation is inevitable; and the situation of such houses as are near trees exposes them every autumn to the danger of overflows from gutters stopped up with dead leaves. Roofs, to remain dry, should be of sufficiently steep pitch for the nature of their covering; flat tiles requiring a steeper roof than "pan tiles," and these latter a steeper roof than slates. Whatever the covering the material should be good and well secured. Roofs should be so arranged as to dispense, as far as possible, with gutters and flats occurring in the middle of the building, but should, if practicable, throw off the whole of their water to the sides. The points where they join walls, parapets, and chimneys, are especially vulnerable, and should be especially protected, either by a lead "flashing" or by a cement fillet, with a small projection formed to overhang it in the brickwork. It is essential that tiles or slates should overlap one another sufficiently, and that if the covering be of metal (as lead, zinc, or copper), it should be so laid as to be free to expand or to contract with change of temperature; and in exposed situations it is essential for tiles, and desirable for slates, to be bedded in mortar. This, however, must be so done as not to prevent there being a clear drip from one tile or slate on to another; otherwise the mortar will become saturated, and will conduct the water to the inside of the roof.

### Remedy for Rattling Window Sashes.

The sashes in very many costly and elegant dwellings are frequently so loose, from some cause, that when winds blow even gently they will rattle and bang from stop to stop, like the shrunken and decayed portions of some forsaken and dilapidated castle.

In some instances the sashes are fitted with too much play, both in the direction from one jamb-casing to the other, and also from the outer to the inner stops. Besides this, the shrinkage of the stiles of the sashes and the contraction of half-seasoned timber, of which the stops were made, have contributed to increase the defect alluded to, so that the annoying rattle and clatter during the night will frequently drive sleep from every eyelid. The unwelcome music of rattling windows will often arouse and electrify nervous and timorous persons quite as effectually as if a band of burglars were making an entrance into the dwelling.

The remedy is by no means difficult or expensive. Let the sashes be taken out of the window frame, and every part of the window examined. If the jamb-casings have been sprung, or are warped and twisted, the first step will be to remove the stops and straighten the face of the casings, which may be done most conveniently with a large rabbet-plane and a smoothing-plane. In case the sashes should be much too narrow for the frame, let one edge be dressed off true, and a thin strip fitted neatly, and glued and nailed to the edge of one stile. See that the outside edge of such stile is not tapering, even by the thickness of a heavy shaving. When the stiles are tapering only a trifle, the sashes cannot be moved up and down easily. Now put the upper sash in its place, and fasten the central stop with two or three long, slender wood screws, after which remove the outside stops and place them so closely to the stiles of the sash that the window will not rattle.

Then let the stops be secured on the inside so closely to the stiles of the sash that it will move up and down easily, without having so much play that the wind will rattle it. When the sashes have been fitted as directed, there will be no more need of "weather strips" of any kind to exclude dust and cold air, and the expense of refitting a window as directed will be much less than the cost of weather strips.—*Technologist.*

### Plastered Walls and Ceilings.

Particular care should be used in selection as to the strength and length of the hair to be used in the plaster for ceilings, and also as to the substance of the laths, which should in all cases be double. The plaster should be laid on with the minimum of thickness, a point much neglected.

With regard to the quality of the sand, it cannot be too good. Sand is apt to make the plaster too "short," only when there has been too much employed, and that with weak chalk-lime. It is impossible that the admixture of loamy earth in any proportion can benefit any description of mortar or plaster, and therefore clean grit must be preferable to either pit or road sand, for loam in any shape is detrimental in proportion to its amount.

One word with regard to a possible substitute for hair, as hair is becoming every day more difficult to obtain. In the pulling down of portions of old work for the reparation of the Lollards' Tower at Lambeth lately, some plaster of remarkable hardness was found; it was far superior to any of the rest, and upon examination was discovered to have been mixed with chopped rye-straw (recognized by several of the heads which had been mixed up) instead of hair. This plaster was wonderfully sound and firm. Possibly other descriptions of straw might be found equally suitable for the purpose, and at any rate it would be quite worth making some experiments on this subject.

Having obtained a really good plaster to work with, it is much to be wished that it might be applied in a somewhat more solid and durable manner than is usual, and that instead of flimsy laths nailed under the joists or on each side of partitions to receive it, short pieces of wood were fixed in between the joists or quarters, and the plaster trowelled on from front and back, so as completely to envelope these pieces of wood. By this means the plastering on partitions and ceilings would not be merely suspended coats, but integral portions of the structure, which, when dry would become almost imperishable and incombustible. Thus, instead of being flimsy, ill-connected things, inviting fire to destroy them, and the means of conducting that destroying element to all the other portions of the building, they would be, as it were, thin vertical or horizontal shields to prevent fire from spreading and touching the timbers. The use of plaster is, to a certain extent, common in Europe, and well deserves the attention of architects

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## FACTS AND FIGURES ABOUT THE MONT CENIS TUNNEL.

Late cable news contains the great fact at last, that, theoretically speaking, light has penetrated the Alps. The workmen on the Italian side have exchanged greeting with those on the French side, and nothing remains now to be done but the finishing of the "enlargements." This tunnel completes the continuous rail line of the same gage, from the English Channel to Brindisi, in the south of Italy, 1,890 miles in length, which latter point is even now the great Mediterranean port, for the departure and arrival of steamships for the East *via* Suez Canal.

Mont Cenis lies between "St. Jean de Maurienne," in Savoy, and "Susa," in Piedmont, consisting of a high table land 7,000 feet high, rising abruptly to a peak nearly 12,000 feet high. The first Napoleon built a road 18 feet wide over this mountain, costing 7,000,000 francs. Then followed the railroad with three rails in 1867, which has had fearful snows, and heavy gradients to contend with, and, being of narrow gage, has been only of temporary benefit.

The tunnel was commenced in 1857, and work has been unceasing day and night ever since. Its length is 7 miles, 1,020 yards. "Bardonneche" is the name of the Italian end, while the French terminus is called "Fourneaux." The Italian end is 4,380 feet above the level of the sea, the French end being elevated 3,946 feet. The tunnel grade line is 1 in 2,800, rising from the Italian end, to about the center, then falling 1 in 45 to the French end.

The rock passed through seems to have been schist, quartz, and limestone. Commencing at the French end, there was schist for about 2,400 yards; average progress, 4 feet per day; then 550 yards of quartz, average progress, 2 feet per day; then limestone for about 3,000 yards, average progress, 7 feet per day; the balance of the distance being principally schist, with an average progress of 5 feet per day.

The tunnel is 25 feet wide and 24 feet high, and during the prosecution of the work was divided by a temporary wooden flooring into two galleries—one above, the other below—bad air passing out of the former, and fresh being supplied by the latter. About 4½ miles was done from the Italian end, and the rest from the French. Four years after the boring was commenced, compressed air was first used for running drills on the Italian side. Immense "compressers" were necessary, which were worked by water-power, and the air compressed to one sixth, or a pressure of six atmospheres. Ten machine drills have been constantly at work at each end, but those on the French side did not begin until 1863. Powder and nitro-glycerin were used, but we have no statistics as to their relative merits.

The "shifts" were 8 hours each, similar to those on the Hoosac tunnel, giving the men 16 hours rest alternately. The wages paid miners were about 5 francs per day, and "muckers" about three francs per day.

Many lives have necessarily been lost during this great work, but far less than one would suppose; probably from 600 to 800 in all, so far as we have heard from time to time.

We have not seen the whole cost of the work mentioned so far, but it cannot be much short of 160,000,000 francs, or $30,920,000.

## WHAT OUGHT A MECHANIC TO KNOW?

We cannot answer this question for every special trade, but there are certain principles involved which apply to all conditions of labor, and these we can employ for the solution of the inquiry. There was a time when to labor with the hands was a disgrace, and from the number of poor doctors, briefless lawyers, and churchless divines there are to be met with even now-a-days, we wight infer that some people still had a lingering fear of soiling their fingers with undignified labor.

According to an old India legend, the priesthood came from the head, the soldier from the arms, and the mechanic from the feet, of the god Brahma. It was in the interest of the priesthood to keep out all knowledge, as their religion was founded on superstition, and would not bear the light of science. No doubt the mechanic of those days was expected to know very little, as very little was required of him, and civilization and the arts were made to suffer in consequence. Some important discoveries were made, notwithstanding the discouraging circumstances, but nobody knew how to use them. The Chinese invented gunpowder several thousand years ago, but did not know how to use it for any other purpose than for fire-works. Many chemical compounds were known to the Arabs, but they appear to have had no application for them. There was a want of knowledge on all sides—progress was necessarily slow.

We have attained great prosperity in our day, because our industry has been raised to the high condition of art. If we do not wish to retrograde, we must take care that our mechanics receive an education in many branches of knowledge, and we now propose to point out what some of the requirements are.

The mechanic must learn to know the forces of nature, in order to apply them to his wants. If he does not understand these forces he will be constantly exposed to errors and loss. Arkwright labored for years upon his loom, without being able to complete it, and it was not until his partner, Strutt, brought a knowledge of mechanics to bear, that the invention was perfected. Watt could never have constructed his steam engine if he had not previously learned from Dr Black the laws governing the expansion of vapors; and he had the good fortune to live in an age where there were enough people who understood the laws of physics to be able to appreciate and sustain his invention, The celebrated French Professor Papin was not so fortnnate. He attempted to construct a steamboat in 1690, and was so far successful as to propel it as far as the source of the Weser river. In order to descend this river with his boat it was necessary for him to obtain the consent of the king of Hanover. He accordingly wrote a letter to the great German philosopher, Leibnitz, accompanied by plans and specifications of his invention, and asking the powerful interposition of the philosopher, with the ministry, to obtain this permission. The original letter is preserved in the library at Hanover, and the petition of Leibnitz, also, sustaining with all the forethought of a great mind, the request of the French refugee; but the opposition of the boatmen and the *ignorance* of the ministry defeated the whole enterprise, and Papin was driven out of the country, and is supposed to have died in great poverty in England.

The laws of nature that the mechanic must understand are classed under the general name of physics; heat, light, electricity, and magnetism, are the distinguishing forces, and they ought to be well understood and studied by every artizan. According to the modern law of conservation the sum total of forces in the universe is the same now as at the creation, the only difference being that they have exchanged places. If we let a ball fall to the earth, the motion imparted by gravitation does not cease when the ball is stopped, but it is changed to a motion of the smaller particles, and this latter movement is what we term heat. The asserted base is, in fact, warmer than it was before. We can, by means of one force create another, or we can substitute one force for another. And in all this we must keep in view that it is work that we wish to accomplish. A machine that will accomplish no work is of no value in our day.

The mechanic ought also to study the elements that are subject to physical laws. This branch of knowledge is called chemistry. It involves the study of the properties and uses of all ponderable matter. What are called elementary substances constitute the stock-in-trade of all the arts and sciences, and it is as necessary for the mechanic to understand them as it is for the merchant to be familiar with the goods he sells.

The mechanic must study mathematics. This branch of knowledge is the language and the key to all other sciences, and it is indispensable to success everywhere.

A knowledge of political economy and of the laws of trade is also necessary. The mechanic ought to understand the relation of labor to capital and the laws of commerce. With a knowledge of these branches of science and a skill in the use of implements, the mechanic in our age is the lord of creation, and every rank and honor is open to him. He is everywhere welcomed, for his presence increases the wealth and power of the land.

It is the fashion at the present time to exalt labor, and yet it is not often that the so called man of education takes to a trade. The old prejudices against labor still obtain, and our young men rush into commerce, or what are called the learned professions. This is a great mistake, and can be in a measure remedied by giving to the mechanic a higher education. The noble institution of Mr. Peter Cooper will go far to meet the want in our city, and future generations will cherish the memory of its founder as one of the benefactors of his race.

In a play called "The Carpenter of Rouen," the dignity and importance of the mechanic is thus aptly illustrated:

"The mechanic is God's nobleman. What have mechanics not done? Have they not opened the secret chambers of the mighty deep and extracted its treasures, and made the raging billows their highway, on which they ride as on a tame steed? Are not the elements of fire and water chained to the crank, and, at the mechanic's bidding, compelled to turn it? Have not mechanics opened the bowels of the earth, and made the products contribute to their wants? The forked lightning is their plaything, and they ride triumphantly on the wings of the mighty winds. To the wise they are floodgates of knowledge, and kings and queens are decorated with their handy-works. He who made the Universe was a great mechanic."

## RAILROAD MONOPOLIES.

We see in the future of this country no danger more threatening than the growth and existence of enormous monopolies, particularly railroad monopolies. The past has demonstrated that our system of government gives almost unlimited scope for the growth of these enormous fungi upon the body politic. Their roots have struck deep, and their crimes against public morals smell to heaven.

Entertaining these views we have perused with great interest an article in the *North American Review* for January, from the pen of Charles Francis Adams, Jr., entitled the "*Government and Railroad Corporations.*"

It needed not the vigorous pen of Mr. Adams to arouse the thinking men of this country to the peril of permitting these greedy corporations to continue their operations unchecked. The great problem with such men has been to devise any check that could be hoped to prove efficient under our present system of government. The corruption which exists in our civil service, the ease with which legislative bodies are manipulated, the lack of fidelity in judicial administration, each of which evils are mainly attributable to the corrupt influence of these bloated corporations, render almost any scheme of railroad reform hopeless.

Lest we should be classed among those pessimists who believe the world is going to the bad altogether, and that nothing whatever can stop it, we hasten to say that we believe in the great law of compensations, in social as well as natural progress. We do not believe the evils complained of are to be perpetual, but we do believe that no harder problem has ever presented itself to American statesmen than this of railway reform.

Seventeen years ago (writes Mr. Adams), six roads divided the route between Albany and Buffalo, and in 1853 these were consolidated into one. Three years ago four roads connected New York with Chicago, and these four were then reduced to two. One year ago five roads divided among them the distance between the Atlantic and the Pacific; six months ago these five were practically reduced to three. How long will it be before these three are reduced to one? How long before consolidation, as yet confined to connecting, will extend to competing roads? It is perfectly useless to discuss the question whether this massing of wealth and of power is desirable or otherwise. It is sufficient to recognize the fact that it is inevitable—that it is a natural law of growth. Legislation could only wage a futile war against it: checked in one form, it would devise another; by indirections it would find directions out. It has been steadily going on from the beginning; it is now going on, and it is not likely to stop. No legislation can prevent it, even were such prevention desirable. Any attempt in this direction will but result in a recourse to subterfuge, and the practical reduction of law to a dead letter. You cannot prevent, but you may, by looking at facts as they are, not inefficiently regulate. How this can best be done is the problem.

Whether Mr. Adams means, in the last sentence of this extract, to intimate the mere possibility of regulating railroads, or to assert his opinion that a system of regulation can be practically applied at this juncture, is not altogether clear.

Speaking of the assumption of railroad jurisdiction by the national government, he says: "It is impossible, in view of past experience, not to entertain grave doubts as to the result of any experiment of this sort, made through the political machinery which exists in America." As a substitute for such an assumption of railroad jurisdiction by the general government—which, he predicts, must come sooner or later—and for State regulation or control, which last he regards as but "temporizing expedients," important simply as illustrating the practical value of certain theories, he makes the following suggestion:

A safer solution of the difficulty may not improbably yet be found in effective regulation, than in State ownership. This last looks to the destruction of the principle of private corporate life as the basis of the railroad system, and to the adoption of the whole of it into the body politic. Regulation, on the other hand, proposes to have the government, while preserving the separation between the body politic and all private industry, yet exercise an active control over its own creations. This is the tendency of legislation in many of the Western States, where the results of government meddling are still fresh in the popular memory. Foremost among these States is Illinois. In the remarkable constitution just adopted there the great principle is for the first time recognized that the railroad system is exceptional among all industrial pursuits, and must be recognized and dealt with as such. This in itself is an immense stride in advance. The one striking feature of the Illinois constitution is the strong resolve of its framers to do away with what are known in England as "private bills," and in this country as special legislation. A sound system of government should recognize individuals no more than the laws of nature recognize them. The law should apply to all, without discrimination for or against

This final result is not attained in the Illinois constitution; had it been, the value of that instrument would have been more than doubled. Indeed, the provision made in it brings the innovator just to the fatal point; as yet he has done nothing, but the next step involves everything. In spite of its constitution Illinois must now slip back in the deep mire of special railroad legislation, or it must go on and solve the problem. The case stands thus: the constitution implies the

passage of (1) laws prescribing reasonable rates of charges on the different railroads, and (2) laws to correct abuses and prevent unjust discrimination and extortion in the rates of freight and passenger tariffs.

Now it is easy to talk about abolishing the evil of special legislation, but *how* is the yet unanswered question. Does anybody believe that in the State of New York a body of men could be convened to amend the constitution who would not be, at least enough of them, directly or indirectly chosen by those corporations who are always on the lookout lest their power should be crippled? If we could be certain of representation by incorruptible men, if legislative enactments were no longer influenced by bribery, if rings, and lobbies, and factions, did not rule, and government was in truth as in name, vested in the hands of the people, there might be some hope of speedy cure for our disease, but when the whole body politic is impregnated with virus, and these unsightly and loathsome excrescences burden every part, and sap the vitals of our institutions, the advice of Mr. Adams is like telling us to put salt on the tails of the birds we would catch.

It is easier far to point out defects in our system than to prescribe remedies for them. Mr. Adams has in his article shown in a strong light many of these defects; we fear, however, that only one of those compensations by which "time makes all things even," in human affairs as well as in physical phenomena, will enable us to slough off these rotten monopolies.

## AMERICAN GAS WELLS.

The discovery of petroleum, and still more, the series of remarkable discoveries relative to its complex composition, and the seemingly almost interminable series of products which may be derived from it, have produced an effect upon modern industry the magnitude of which is probably but dimly appreciated, even by those most familiar with the subject. The boring for petroleum has also resulted in the discovery of natural gas deposits of great magnitude, from which the flow seems unlimited, and which may possibly lead to results of nearly as great importance as those which have accrued from the discovery of petroleum.

At present no one can tell the number or the location of these gas deposits. Still more is it impossible to determine the nature of the mysterious process going on in nature's subterranean laboratory, by which these gases are generated. This much, however, seems probable, that the generation of the gases in question is continuous, rather than the result of some former chemical action, by which an accumulation has been stored up, and from which the supply is now obtained. This view is based on the fact that the flow seems increasing rather than diminishing in volume, even from wells that have been delivering gas for years.

The most important of these natural gas deposits yet discovered, seems to be at Erie, Pa., and the present article will be chiefly confined to a consideration of these, with a brief sketch of their development, and the industrial uses by which the gas has been found applicable, compiled from facts placed in our possession by correspondence, and articles which have appeared from time to time in the Erie newspapers.

The first well at Erie was discovered in 1859. In this year an adventurous oil-seeker commenced boring for oil at a point near what is now called Eighteenth street, and after boring to a depth of about two hundred feet, relinquished the undertaking, although there were strong indications of oil, and an abundant flow of gas. The drilling was performed by the old spring-pole method, and though one or two attempts were made by other parties to sink the well deeper by the same method, the work was so arduous that the well was finally abandoned in the fall of 1860.

During the summer and fall of the same year a second well was sunk not far from the first, and at a depth of twenty feet a large amount of gas commenced flowing. This gas burned with a brilliant flame, and deposited a whitish material resembling paraffine, or "a fatty substance not unlike, in color and consistency, a yellowish-white butter." This well was worked by hand for some time, and made very slow progress. The work was continued for about three years, when oil was struck, and the well being tubed and pumped, gave a yield of only about one barrel per day. Last summer the tubing was withdrawn, and some modifications made, which permitted the free escape of the gas, when the yield was increased to from three to four barrels of fine, heavy, lubricating oil per day.

In 1864 a well was sunk by the "Erie City Oil Company," to the depth of 780 feet. No oil was obtained, but a very large flow of gas has issued ever since from the boring. The well being abandoned by the company, an enterprising soap manufacturer caused it to be tubed, and has used the gas for five years as fuel and lighting material for his factory, and also now heats and lights his dwelling-house, near by, by the same gas. He boils six large kettles in his factory, besides lighting and warming it, and uses no other fuel whatever. The flow of gas from this well is stated to be on the increase. A considerable surplus over what is used for the above-mentioned purposes escapes.

In 1865 another well was sunk, which, at the depth of 640 feet, yielded a supply of gas sufficient to light a number of manufacturing establishments, and to generate steam at the "Erie City Iron Works."

There are now no less than eighteen completed gas wells, five in progress, and three shortly to be commenced.

Among these may be specially mentioned the "Water Works Well." Of this well the Erie *Daily Republican* says: "Its depth is 565 feet. For the first five weeks the gas was sufficient to make all the steam necessary in pumping 500,000 gallons of water per day (the amount then used in the city). At the present time the amount of water used is 1,000,000 gallons per day, and it is found necessary to use some coal. The present supply of gas is equal to from two and a half to three tuns of coal per day. The derrick and fixtures for a second well are now being put up, and it is proposed to go down at least one thousand feet or far enough to thoroughly test the question of both oil and gas."

A well near Tenth street for several months supplied sufficient gas to run a large distillery; but, becoming filled with water, it is at present idle.

One between Fifth and Sixth streets furnishes an equivalent of from two and one half to three tuns of coal daily to the "Canal Mills."

A well at the Fairmount Mills furnishes gas enough to light and warm the mill, with a large surplus, which is burned nightly in a mammoth street light just west of the mill.

The "Hopedale Flouring Mills" obtain enough gas from their well to drive a thirty-horse power engine, and to light and warm the mill. Of this well the paper above quoted remarks:

"It was first used about the 1st of October, and has not been relieved of any water since that time, and the flow has been very uniform. When the engineer first commenced, he marked the cock that supplies the boiler, so that he might determine the pressure. The result is, that there has not been the thirty-second part of an inch difference, one way or another. The furnace under the boiler is supplied entirely with gas, the mill warmed and lighted, Mr. Gingrich, the proprietor, warms and lights his house, his miller does the same, and a brewery is furnished with an amount sufficient to run one fire, several lights, and a ten-horse power engine. After supplying all these it is estimated that there still remains a surplus of from 35 to 40 per cent, which is allowed to escape. It is supposed that the well is about half full of water, and it is the intention to pump it out in a short time, to see what effect it may have upon the flow; but inasmuch as the supply greatly exceeds the demand, an increase is not a particular object at present. This may be set down as one of the best wells in the city. Seed-bag 210 feet from surface."

"A well located on Tenth street, in the yard of the Presque Isle Iron Works, has been used under the boiler and for lights and fuel, throughout these extensive works, since the last of August. The supply, although large, is hardly equal to the demand during the winter season, and another well is now being put down in the eastern part of the yard, which is now down seventy-five feet, and has an excellent show of gas, having struck a fine vein about twenty-five feet below the surface. The first well is 542 feet deep, and it is thought by the proprietors that the veins were partially filled up by allowing too much water and mud to accumulate. It is proposed, therefore, to work the new well as a dry hole."

The gas company put down a well last fall, which has been in use about six weeks. Its depth is 700 feet, and it is estimated to produce 1,000 cubic feet per day, which proves to be so profitable to the company that they have commenced a second well on Seventh street, east of the large gasometer.

It seems that this gas may be obtained anywhere in the vicinity of Erie, by boring for it, and if, as the prolonged tests already made indicate, the supply is a permanent one, it must add greatly to the resources (already large) of that city, as a manufacturing center.

## THE U. S. SIGNAL SERVICE AND STORM SIGNALS.

Mr. A. Watson has addressed a circular letter to the members of the Congressional Committees on Agriculture, Commerce, and Military Affairs, setting forth that, mainly through his efforts during more than three years, a resolution was passed at the last session of Congress authorizing the Secretary of War to establish at military stations a system of storm warnings by means of telegraph and *signals* for the benefit of commerce. The letter further states that the chief signal officer who was charged with the execution of the law, at first agreed to test Mr. Watson's plan at forts and military stations, as was obviously intended; the resolution expressly mentioning *signals at military stations*. The circular further asserts that in place of establishing signals, as required by the resolution, the Chief Signal Officer has adopted the old system of weather reports published in the newspapers, entirely ignoring the law which calls for signals at military stations. This plan was tried for several years previous to the war by the Smithsonian Institution, and failed of any practical result. Under the Institution it was conducted without expense, but under the Chief Signal Officer it is very expensive. This system is too slow, is limited in its operation, is complicated, is neither applicable to commerce, agriculture, or floods, and, in Mr. Watson's opinion, will result in an expensive failure.

In order to induce the Secretary of War to test his plan—which we will explain further on—Mr. Watson has obtained and embodied in his circular requests from the mayors of nearly all the principal cities having forts or military stations and complete telegraph connections, and also requests of the governors of five States, with which requests he now appeals to Congress to pass a resolution ordering the Secretary of War to test his plan, for which he claims that an appropriation of only $1,000 is needed. The places at which he is anxious to have the system tested are Cincinnati, Ohio, Baltimore, Md., Washington, D. C., Boston, Mass., New York, Philadelphia, Troy, N. Y., Annapolis, Md., and Portland, Me., as requested by the mayors of the cities or the governors of the States in which these cities are located.

The success or failure of these experiments would determine whether the system of signals proposed by Mr. Watson could be profitably extended to embrace all the principal points in the United States.

This system is one substantially the same as one strongly recommended by us some time ago, consisting in a series of pre-arranged signals of discharges of heavy artillery which should announce to agricultural districts the approach of storm and the direction of its course, with the time that might reasonably be expected to elapse before its arrival.

We sincerely hope Mr. Watson may succeed in securing the action which he seeks of Congress upon this important matter. The trifling expense attending the experiments, and the benefits which would result from their success, certainly entitle their promoter to a candid hearing and generous treatment from the public for whose benefit his efforts are exerted.

## NEW CHEMICAL PRODUCTS.

The hydrate of chloral, about which so much has been written during the past year, has now reached the stage of a quack medicine, and, in the hands of designing or ignorant people, is likely to occasion much mischief. It is sold in fluid form as an anodyne, mixed with gum or sugar water, glycerin, or some tincture, and as the strength of the preparation is not given and it is liable to undergo spontaneous decomposition, the patient can never tell how much of a dose he is taking. A bottle of chloral, put up in the usual style of a popular medicine, which was sent to us six months ago for examination, has entirely decomposed, and it would be dangerous to use it, as the nature of the products of decomposition are not well understood. We must utter a note of warning that it is never safe to take the hydrate of chloral unless freshly prepared and upon prescription of a physician. It is a valuable hypnotic medicine, but is not to be trifled with.

NITRATE OF AMYL.—This ether has been known since 1844, but its use in medicine is of recent date. English physicians employ it largely as a remedy for asthma. For this purpose a few drops are poured upon a cloth and inhaled the same as ordinary ether. It is apt to produce violent headaches, and must be inhaled with caution.

PEPSIN.—This valuable preparation has grown into some disrepute in consequence of the spontaneous decomposition of its solutions. It has been made in a peculiar way by Dr. Liebreich, by which its keeping properties have been much improved. It is an agent that ought to be experimented upon in cases of diphtheria, diarrhea, purification of drinking water, indigestion, and dyspepsia.

## VAPOR LAMPS AND VAPOR STOVES.

We constantly read of explosions and loss of life from the use of naphtha, benzine, and dangerous oils, in what are called vapor lamps and vapor stoves. These instruments of destruction are constructed with a reservoir placed above the stove, filled with the lightest and cheapest products from the distillation of petroleum. The highly combustible liquid is allowed to flow through a small orifice upon a hot plate, where it is ignited and burnt in a way to give out light or heat, according to circumstances. While it burns there is no danger of explosion, and if the apparatus were perfectly tight and there were no leakage, as soon as the stop cock was closed the fire would go out and no explosive gas would be produced; but here is the point of danger. A small leak or a little carelessness would easily fill the space with an explosive mixture of hydrocarbon gas with the atmosphere, and when an attempt is made to kindle the fire, the stove is worse than a powder magazine. It has been proposed to use gunpowder as a motive power, by allowing it to be fed through an hour-glass arrangement into a box where it could be exploded by electricity, but the difficulty of regulating the flow of the grains, and the uncertainty of the discharges, rendered the attempt to employ powder for machinery nugatory. These modern inventions for burning naphtha are very much on the same principle, and ought to be handled with extreme care. It is a question whether the fire commissioners ought not to prohibit their use altogether.

## Personal Brevities.

The health of Sir R. Murchison is improving, and the case of Prof. B. Stewart, recently injured in a railroad accident, is progressing as satisfactorily as could be desired.

Mr. C. L. Bloxam, the author of several valuable text books, has been elected to succeed the late Professor W. A. Miller, as Professor of Chemistry, in King's College, London.

Dr. Debus has been appointed Examiner in Chemistry to the University of London, in the place of the late Dr. Matthiessen.

The lectures at some of the German universities are very thinly attended, as many of the students are in the army. At Marburg part of the courses is entirely suspended. At Göttingen only half the usual number of students are in attendance.

Professors Dumas and Deville are shut up in Paris; their families, however, are in Switzerland. Their scientific investigations are now chiefly confined to warlike and sanitary questions. Berthelot and Jarvin are also active in the same direction, but the two Becquerels have left Paris, much to the disgust of the Committee of Defense.

DANGER FROM USING OLD PETROLEUM BARRELS.—A case of poisoning has been reported in Germany from the drinking of cider that had been preserved in an old petroleum barrel, although the cask was thoroughly cleansed before using. After the funeral of the first victim the grave diggers returned to the house and partook of the same drink; one of them soon afterwards died, and the others had a narrow escape. It is well for the public to know that petroleum acts as a poison, the symptoms being dizziness and vomiting, and it is unsafe to use the old barrels for the storing of any articles of food or drink.

## PROGRESS OF FOREIGN INVENTION.

PRESERVATION OF VEGETABLE LIQUIDS AND INFUSIONS.

A new English invention for the better preparing, clarifying, and preserving of vegetable juices and other liquids, such as lime and other fruit, juices, wines, malt liquors, cordials, and saccharine, or other vegetable or organic solutions, has just been announced. It consists in using for these purposes, singly or in combination with one another or with other substances, silica, hydrochloric acid, potassium, tannin, olein, essential or aromatic oils containing sulphur, glycerin, nitrides, hyponitrites, hyponitrates, and hyposulphites. Many of these substances have long been known and used for the purposes specified, and it is difficult to see how such a patent as this can be defended should it ever be contested.

PERFORATED GRATE BARS.

Another English invention is the making of grate bars perforated so as to permit the free passage of air through the bars, by which means they are constantly kept cooled, thereby preventing clinker or dross adhering to the bars, also preventing the burning, wear, and destruction of the bars through heat, and affording facility for the proper cleansing of the bars. Secondly, the perforations in the bars being in slanting and opposite directions to each other, the free passage of air through the bars to engines running short journeys is obtained without the engines being turned, and the bars are thus kept constantly cool in whichever direction the engine may be running.

MUSIC WRITING MACHINE.

An ingenious French invention is a machine for writing music. The inventor passes over a metal cylinder turning regularly by means of a clock movement and communicating with a battery, a band of paper impregnated with a solution that will decompose under the influence of an electric current, as in telegraphic apparatus according to Caselli's and other systems. The clock movement may be put in motion or stopped at will by an electric or mechanical stop or detent. The band of paper being placed on the cylinder, the inventor places above it a series of metal wires or plates isolated from each other in such a way that as they rest at one point on the paper in a parallel direction to the axis of the cylinder, they each communicate by means of a separate metallic wire with a contact apparatus placed under each of the keys of the keyboard of the instrument. These contact apparatuses are worked by the motion of the key, either by bringing together two wires or metallic plates, or by plunging one point in a jar of mercury communicating with the battery. The circuit is thus closed for each of the wires only when the key corresponding to it is lowered.

DRAWING FRAME FOR COTTON.

This is an English invention and consists in placing on an ordinary drawing frame, and at a convenient distance in front of the front drawing rollers, a series of short tubes, one for each sliver, in such a way that the tubes are capable of revolving whilst the slivers pass through the center, the tubes being caused to revolve rapidly by means of an endless strap or band passing round and driven by a pulley which receives its motion from the main driving shaft or any other convenient shaft of the frame.

CARTRIDGES.

An Austrian inventor makes cartridges with packing preferably of paper in the form of a small ring or disk of the size of the primer or cap-cavity; the ring or disk is placed either on the primer or in the cavity, and the primer or cap is then pressed down tightly on the same. Instead of paper the inventor may use other materials which are softer than the material from which are made the cartridges, primers, and primer cavities.

IMPROVEMENT IN PROJECTILES.

An English device consists in applying the projective force by means of an annular cartridge approximately to the center of gravity of a hollow cylindrical or tubular projectile, instead of, as is usual, at the base; a rotary motion being, if desired, imparted to the projectile by rifling it externally and internally. The projectile or shot is in the form of a hollow cylinder, thus destroying the vacuum in the rear of the shot, and is of the same internal diameter throughout its length and for part of its length, such part being the rear end of the shot, of the same thickness.

PRESERVING WOOD.

This invention is also English. The process is as follows: The inventor places the wood in a closed cylinder or other chamber of any construction or form, in which it is heated by the vapors of liquid hydrocarbon, such as creosote or dead oil, coal tar, wood tar, resins, and bituminous substances, or by the smoke of wood, peat, or any other matter containing vapors or oils that can be drawn off by heat. One of the ends of each separate piece of wood is made to communicate with the external air, or with condensing pipes or chambers converted with an air pump or other means of producing a vacuum, so as to aid the escape of the sap-moisture and air contained in the wood, which is driven through the pores (dilated by the action of the heat) by the pressure of the vapor in the cylinder or chamber.

### The Oxyhydrogen Gas Light in Buffalo.

We are informed that the Board of Trade of the city of Buffalo have obtained a franchise and organized a company to be styled the Oxyhydrogen Gas Company, having for its object the introduction of the oxyhydrogen gas light into that city. A committee of investigation have visited the oxygen gas works in this city, and with the information thus obtained, we are informed that the work is to proceed at once. It seems, then, that Buffalo is to be the first city in America to adopt this splendid light. We shall watch the progress of this new enterprise with great interest.

### Dyeing Turkey Red.

This is a tedious, long process, and only profitable when produced in large quantities. The most expensive works for this purpose are in Elberfeld, Prussia, and the following is one of the methods there in use:

FIRST OPERATION.—100 pounds of yarn are first boiled in a weak soda lye, and afterwards well rinsed in the river.

SECOND OPERATION.—Soak 25 pounds of sheep-dung for a few days in a solution of 10 pounds of soda; then add to it 6 pounds of olive oil; strain it through a sieve; then handle through this the yarn, skein after skein; wring each out loosely, and lay it on slats, but so that no large lumps accumulate, as it will heat and set it on fire; the yarn must be turned from time to time on the slats, to secure an even drying; then finish the drying in a moderately warm room of 148° Fahrenheit. After it is dry the same operation is gone through with as at first; and the yarn receives from two to four operations through the dung and oil, according to the darkness of the shade wanted; it must be dried each time.

THIRD OPERATION.—6 pounds of olive oil and 10 pounds of soda are mixed in about 6 pails of water; if the oil should not become mixed and some swim on the top, more soda is required. Handle the yarn, skein after skein, through this as before; wring out loosely, and hang it up again to dry; the drying ought to be very slow, so as to give the oil time to ferment in connection with the oxygen, as it is considered that the warm oil can penetrate the fiber better; this operation also is repeated two or three times every time it is dried.

FOURTH OPERATION.—To the old remaining oil-bath add a solution of 10 pounds of soda; take the yarn through again as before, and dry.

FIFTH OPERATION.—Now lay the yarn into a warm solution of 10 pounds of soda for 5 hours, to free it from the superfluous oil not absorbed by the fiber, then rinse it well in the river.

SIXTH OPERATION.—Take the yarn through a decoction of 20 pounds of ground nutgalls and 10 pounds of sumach, in sufficient water, skein after skein; wring it out, and dry in the open air; turn it often, so as to secure an even color.

SEVENTH OPERATION.—30 pounds of good alum, free from any iron, such as will not show a blue shade if a few drops of yellow prussiate of potash solution are added; otherwise it will not make a bright color. This alum is neutralized from its free sulphuric acid by a solution of 3 pounds of soda slowly added, so as not to boil it over by the too sudden escape of carbonic acid gas; pass the yarn through this yet warm solution of alum, wring it out, and dry as before, but not too hot, as the acid of the alum might injure the cotton or crystallize the alum.

EIGHTH OPERATION.—The yarn is now freed from the loosely superfluous alum adhering to the fiber by soaking it in warm water, and rinsing well in the river.

NINTH OPERATION.—Into a suitable warm bath stir 100 pounds of good madder; add 50 pounds of beef blood; stir it well and enter the yarn; handle quick at first, so as to get it even, and bring it to a boil during 1 hour; then sling the skeins together and drop them into the liquor, and let them boil for one hour. It will be surer even by coloring only 25 pounds of yarn at a time; then rinse it.

TENTH OPERATION.—The yarn is again taken through an oil bath with soda as before and dried; then boil it in a solution of 5 pounds of olive oil, 6 pounds of castile soap, and 5 pounds of soda, from which it will come out bright red; then rinse it.

ELEVENTH OPERATION.—To still more brighten the color, without drying, put the yarn into clean bags and boil it for 2 hours in a bath containing 15 pounds of good white soap, 1½ pounds of tin crystals, and ½ pound of nitric acid.

Then take it out, rinse while yet hot, when it will be at last done.

This is the only fast-red which is good for bleached goods; others are less durable.—*The Art of Dyeing, by Haserick.*

### Ideas Expressed in Modified Forms of Screws.

Every modification of the screw propeller, from the form of a common right helicoid, or "true screw," except some merely fanciful or arbitrary ones, has been the result of a certain determining idea, suggested or confirmed by experiment or reflection.

The idea of axial expanding pitch.—In this case, it being known that a screw, beginning to work in smooth water, soon acts to move rearward a column of water, the idea is that, as the entering element of the blade moves the water as described, the next element should, so to speak, chase it up, so as to press upon the moving water as heavily and effectually as the first element. This second element would give an increment of velocity to the already moving water, and so the third element, by a continued expansion of the pitch, would move backward faster yet, so as to catch up with the water, just as men, to push a rail car with a uniform pressure as its speed increases, must walk faster and faster.

The idea of radially expanding pitch, and of all screws which, by having a curved generatrix, appear bent back, that is, from the vessel, in a side view of the latter, is, to counteract the centrifugal action of the water, and confine it to a cylindrical column, having the disk (end elevation) of the screw for its base.

Among the most curious screws of this kind is Holm's conchoidal screw, having a rapidly expanding axial pitch, so that at the trailing edge the blade is tangent to a plane containing the axis of the screw, and therefore has, at that point, an infinite pitch. Also, at the outer circumference the edge of the blade is bent over from the vessel into a narrow cylindrical flange, which finally is rounded into the trailing edge at the corner, by a spherical or spoon-shaped surface.

Finally, the opposite idea of bending the blades toward the vessel, and of mounting them on rings, so as to leave the central portion of the disk open, is, to favor the rush of water from all sides into the partial vacuum which tends to exist behind, or on the after side of the screw. In the Griffith screw, the blades are widest at about the middle of their length, are bent towards the vessel, and are fitted by cylindrical arms into similar sockets in a large spherical hub or "boss." Each can be turned on the axis of its cylindrical arm, and thus the pitch is variable.

While preparing these pages, I am informed by an engineering friend who has made the experiment, that if sawdust be poured upon a screw model, while the latter revolves rapidly in a lathe, it will rather be drawn towards the axis of the screw than dispersed by the centrifugal force, developed by the rotation.

The result just stated may be explained as follows: The rearward discharge, by the screw, of a cylinder of water creates a constant tendency to a vacuum at the position of the screw. This tendency, being constant, is as effectual as a sensible vacuum, in inducing a constant rush of water from all sides to the spot where the screw works. This centripetal rush of water is believed to prevail over its centrifugal tendency, so that some, instead of bending the blades aft, or from the vessel, to confine the water radially, and so prevent its lateral dispersion, and discharge it rearward in an undiminished cylinder, have bent them forward, as already explained, or towards the vessel, in order to favor the inward rush of surrounding water at the base of the water cylinder acted upon by the screw. The Griffith screw, as said before, is thus formed.—*Elements of Machine Construction and Drawing.*

### Adulterated Sirup.

The following paragraph has been going the rounds of the papers:

"John H. Pope, druggist, of New Orleans, says that the substance known as 'sugar drips,' and retailed as 'golden sirup,' contains no sugar at all, but is produced by the destructive action of strong sulphuric acid (oil of vitriol) upon starch. To test the difference between this and cane sirip, dissolve a teaspoonful of the 'golden sirup' in a wineglass of rain water; then add a few grains of tannic acid, when it will turn black as ink if the article is spurious. If the acid be not convenient to procure, make a cup of strong tea (which contains tannin), and add a teaspoonful of the 'golden sirup,' and a fair quality of ink will appear."

Prof. C. F. Chandler, in the *American Chemist*, comments upon this paragraph as follows:

Genuine sugar-house sirup, "golden sirup," is the liquor drained from the crystallized sugar of the sugar house, after all the sugar that can be profitably extracted from raw sugar has been separated.

The impure, dark-colored, raw sugar of the plantation is dissolved in water, purified, filtered, and decolorized. It is then boiled down in the vacuum-pan till it begins to granulate, when it is run into molds to cool.

The loaves are drained, cleansed with a saturated solution of pure sugar in water, and sent to market as lump, crushed, powdered, and granulated, "A" sugar.

The sirup which drains out of the loaves, called "greens," is again purified, decolorized, and boiled down to crystallization. The crystals are separated in the centrifugal machine, and sold as a very light-colored coffee-sugar. The "greens" from this sugar yield, by purification, decolorization, and boiling, a light-yellow sugar. The last "greens," after three successive crystallizations of sugar, are purified and sold as "golden sirup." This sirup still contains a considerable quantity of crystallizable sugar, which cannot be profitably extracted, together with uncrystallizable sugar, coloring matter, and the substances which give to sirup its peculiar agreeable flavor, but whose exact nature is not known.

The adulteration complained of is the dilution of this pure sugar-house sirup with sirup made from starch, or the entire substitution of starch sirup for sugar-house sirup. We have no fault to find with this portion of the statement, but the test with tannic acid or strong tea is totally fallacious. It is simply a test for iron, which is much more likely to occur in genuine sugar-house sirup than in the starch sirup complained of. The raw sugar is manufactured in iron vessels; the tanks, pipes, coal filters, molds, and often the vacuum pans in the sugar-house are made of iron, and as the solutions take up small portions of this metal, the sirup often, though not always, contains iron. The refiner is careful to prevent, as far as possible, the introduction of iron into the sugars and sirup, not because it is in any way injurious, but simply because if it occurs in the sugar to any extent, it produces a dark color when used in tea, which consumers dislike. As sirup is not used in tea, there is no real objection to a small proportion of iron; in fact, as iron is a good tonic, its presence is perhaps desirable. The starch sugar which we have seen manufactured on a large scale in Europe, would not be as likely to contain iron. This test, therefore, is simply a test for iron, and not a test for adulterated sirup; in fact, guided by this false test, one would be likely to reject pure sugar-house sirup, and select the starch sirup instead.

OPEN an oyster, retain the liquor in the lower or deep shell, and, if viewed through a microscope, it will be found to contain multitudes of small oysters, covered with shells, and swimming nimbly about—one hundred and twenty of which extend but one inch. Besides these young oysters, the liquor contains a variety of animalculæ, and myriads of three distinct species of worms. Sometimes their light represents a bluish star about the center of the shell, which will be beautifully luminous in a dark room.—*Journal of Microscopy.*

### Molding Figures in Paste, Wax, and Clay.

We clip the following from the *Coachmaker's International Journal*:

TO MOLD OFF FIGURES IN PASTE.—Take the crumbs of a new-drawn white loaf, mold it until it becomes as close as wax, and very pliable; then beat it and roll it with a rolling-pin, as fine and as far as it will go; then point it on molds, and, when it has taken the suitable figure you desire, dry it in a stove, and it will be very hard; and to preserve it from vermin, you may mix a little powder of aloes with it.

TO MOLD SMALL FIGURES OF JASPER COLOR.—Oil your molds with a fine pencil, and diversify them with such colors as you please with gum tragacanth; if they spread or run, put a little of the gall of an ox, for the thicker it is the harder it will be; then mold your paste of the color of jasper, or the like, put it in to fill the mold, tie it with a wire, bake it, or take it out, repair and varnish it, and set it by to harden.

OF MAKING FIGURES OF CLAY OR WAX.—There is no need of many tools in this sort of work; the clay is placed upon an easel or table, and you begin and finish the work with your hands. Those who are used to it never make use of anything but their fingers, except three or four pieces of wood, which are roundish at one end, at the other flat, with a sort of claws and teeth, called by the French, *ebauchoir*—that is, a sort of hatchet; they are about seven or eight inches in length; those with claws are to smooth the stuff; the others, which have teeth, to scratch it.

They are made of wax thus: Take a pound of wax, half a pound of ocher, some add turpentine, and melt it together with oil of olives; put more or less, according as you would have the matter harder or softer; a little vermilion also should be mixed with it to give it a softer color. When you have made the composition, the figure is worked up with the hand, and those *ebauchoirs* made use of in making up the earthen figures. Practice is the principal mistress in this sort of work, which, at first, is not so easy as that in clay.

TO MOLD OFF THE FACE OF A PERSON IN WAX.—Take a pound of new wax, a third of colophony, melt them at a slow fire, let them cool so long as that you may endure some of it on your hand without burning it; then having oiled the face with olive oil, cover the hair of the eye-lids and eye-brows with paste; then with a brush nimbly cover the face about the thickness of a quarter of a dollar, being careful not stop the nostrils, and that the person squeeze not his eyes together, because that will render the face deformed.

Thus, having the face of wax, take it off gently and strengthen it with clay on the back side, that it may not give way. After this manner you may cast all sorts of faces; laughing weeping, grimaces, or wry faces; also fruits or anything else, dividing the mold into two pieces with a warm knife; then fortify them with clay and join them together.

There is no way of casting neater than this with wax, and after a very little practice you can become very expert at the business.

### The Wisdom of the Egyptians.

The moderns are accustomed to pooh-pooh a good deal at people so unfortunate as to live before this nineteenth century; but just think what some of these remote people and times did manage to find out and accomplish for themselves. There was Egypt—oldest and wisest of the nations—what a record for her is deciphered, in the last fifty years, of her past.

What did the old Egyptian know about the oldest of the arts, about farming? He knew how to manage his great river—the one source of moisture and fertility in that climate—so as to turn the desert beyond its banks into a garden, and make Egypt a storehouse and granary for the surrounding nations. He built reservoirs so huge as to retain sufficient water from the overflowing river to feed it when it subsided—a lake four hundred and fifty miles around and three hundred feet deep—and this fitted up with a skillful system of floodgates, dams, and locks. These were water works on a stupendous scale, truly.

As to what he knew about building, who has not heard of his pyramids, those vast masses, some of which were old in the time of Abraham, and yet built with such faithfulness and skill that the masonry is still perfect? He knew how to quarry and move huge blocks of stone, ninety feet in length, and then cover them with accurate and beautiful chiseling. The whole land was full of these wonderful statues, obelisks, tombs, and temples.

About manufacturing, he knew how to weave linen so fine that each separate thread was composed of three hundred and sixty-five small threads twisted together. He knew how to dye it in purple, and blue, and scarlet, and how to embroider it. He knew how to get iron and copper from mines at Sinai, and how to make useful tools of them when obtained.

But what did he know about science? He understood geometry well enough, at least, for land surveying. He understood the rotundity of the earth, the sun's central place in the solar system, the obliquity of the ecliptic. He could foretell eclipses, the position of the planets, the true length of the year. He had found out a method of notation—two of them, indeed, the decimal and the duodecimal. As for chemistry, its very name (from Chemi, which means Egypt), tells us where it was first studied. No wonder that the Egyptians got the reputation, among their more ignorant neighbors, of being magicians. As for books, the old Egyptians made paper and wrote on it, and we have now papyrus rolls made in the time of the early Pharaohs; but he went on further to turn his buildings, his obelisks, even his coffins, into books, inscribing them with histories and biographies, by representing on them, through paintings and sculpture, all his occupations and beliefs, his hopes and fears.

One asks in wonder where he got all this knowledge. Ancient Greece went to him for it, just as the American goes to Germany. We can trace the germs, at least, of our science and art to nations removed from us by ages; but whom did the Egyptians learn from? Were these sons of Ham the first to develop to such a marvelous degree the arts of life? Did they find out by original observation what has been transmitted to us? And through what remote antiquity were they slowly accumulating the experience which qualified them to establish such stable institutions, such settled traditions, such attainments in science and art?

No one can tell. At a point beyond our furthest tradition her records show her to us rich, powerful, cultivated, skillful. Of the long ages before she was able to record her changes, time has long obliterated all traces. The world had long forgotten all about her, till the researches of the last half-century brought to light her long-buried life. Strange enough it is to be brought face to face with the monuments of a civilization compared to which all European history is but of yesterday—which was old in the days of Abraham—and to find there so much in common with our own.

### Commerce of the World.

France exports wines, brandies, silks, fancy articles, furniture, jewelry, clocks, watches, paper, perfumery, and fancy goods generally.

Italy exports corn, oil, flax, wines, essences, dye stuffs, drugs, fine marble, soaps, paintings, engravings, mosaics, and salt.

Prussia exports linens, woolens, zinc, articles of iron, copper, and brass, indigo, wax, hams, musical instruments, tobacco, wine, and porcelain.

Germany exports wool, woolen goods, linens, rags, corn, timber, iron, lead, tin, flax, hemp, wine, wax, tallow, and cattle.

Austria exports minerals, raw and manufactured silk, thread, glass, wax, tar, nutgall, wine, honey, and mathematical instruments.

England exports cotton, woolens, glass, hardware, earthenware, cutlery, iron, steel, metallic wares, salt, coal, watches, tin, silks, and linens.

Russia exports tallow, flax, hemp, flour, iron, copper, linseed, lard, hides, wax, ducks, cordage, bristles, furs, potash, and tar.

Spain exports wine, brandy, oil, fresh and dried fruits, quicksilver, sulphur, corn, saffron, anchovies, silk, and woolens.

China exports tea, rhubarb, musk, ginger, borax, zinc, silks, cassia, filagree works, ivory ware, lackered ware, and morocco.

Hindostan exports gold and silver, cochineal, indigo, sarsaparilla, vanilla, jalap, fustic, campeachy wood, pimento, drugs, and dye stuffs.

Brazil exports coffee, indigo, sugar, rice, hides, dried meats, tallow, gold, diamonds and other precious stones, gums, mahogany, and india rubber.

West Indies export sugar, sugar molasses, rum, tobacco, cigars, mahogany, dye woods, coffee, pimento, fresh fruit, and preserves, wax, ginger, and other spices.

Switzerland exports cattle, cheese, butter, tallow, dried fruits, linen, silks, velvets, lace, jewelry, paper, and gunpowder.

East India exports cloves, nutmegs, mace, pepper, rice, indigo, gold dust, camphor, benzine, sulphur, ivory, rattans, sandal wood, zinc, and nuts.

United States export principally agricultural produce, cotton, tobacco, flour, provisions of all kinds, lumber, turpentine, wearing apparel.—*Iron Age.*

### The Stereoscope.

A recent number of the *American Journal of Chemistry* contained the following story of the first introduction of the stereoscope to the *savans* of France. The Abbé Moigno took the instrument to Arago, and tried to interest him in it; but Arago unluckily had a defect of vision that made him see double, so that in looking into the stereoscope he saw only a medley of four pictures. The Abbé then went to Savart, but he was quite as incapable of appreciating the thing, for he had but one eye. Becquerel was next visited, but he was nearly blind, and consequently cared but little for the new optical toy. The Abbé, not discouraged, called next upon Pouillet, of the Conservatoire des Arts et Metiers. He was a good deal interested in the description of the apparatus, but unfortunately he squinted, and therefore could see nothing in it but a blurred mixture of images. Lastly Biot was tried, but Biot was an earnest advocate of the corpuscular theory of light, and until he could be assured that the new contrivance did not contradict that theory he would not see anything in it. Under the circumstances, the wonder is that the stereoscope ever got fairly into France.

CARTRIDGE MAKING.—The work of making cartridges in Newhallville, Conn., has assumed great proportions since the breaking out of the war. Mr. Sage, the proprietor, has orders for several millions from Europe, and employs 300 girls, forty of whom are colored.

### IMPORTANT PATENT DECISION.

*Seymour et al* vs. *Osborne et al.*—Appeal from the Northern District Circuit Court of New York.—This was an action brought for an infringement of patent in reaping machines. The Court below dismissed the bill, holding that certain improvements, although new in application did not require invention. The Court takes an adverse view and reverses the decree, directing a new trial, Mr. Justice Clifford delivering the opinion of the Court.

This decision involved the validity of the Seymour and Morgan and Palmer and Williams harvester patents. The Court unanimously sustains the patents in every particular. The effect of the decision is to render tributary to these patents every reaping machine using an overhung reel, a quadrant-shaped platform, and a rake sweeping over this platform in a curved path, which practically includes most of the successful machines now in use.

## Business and Personal.

*The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.*


Steel Castings, of the best quality, made from patterns, at Union Steel and Iron Works, Rhinebeck, N.Y.

Steam Vade Mecum.—A Compendium of Simple Rules and Formulæ, for the Solution of all Problems in the Practical Application o Steam. By Julien M. Deby, late Professor at the Ecole Centrale, Brussels. By mail, $1.00. Walter Macdonald, 29 Beekman st., New York city.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4 00 a year. Advertisements 17c. a line.

Taft's Portable Hot Air, Vapor and Shower Bathing Apparatus Address Portable Bath Co., Sag Harbor, N.Y. (Send for Circular.)

Wanted.—A first-class Machinist, familiar with sewing-machine work, and capable of taking charge of a manufactory. Address, with references, etc., A. W. M., Jr., & Co., 29 Beekman st.

Address J. Dane, Jr., Newark, N. J., for best and cheapest Presses, Lathes, Jewelers' Machinery, Small Engines, etc. Machinery and models to order.

Wanted.—Good second-hand 2, 3, or 4 spindle Upright Drills. John Bachelder, Norwich, Conn.

English and American Cotton Machinery and Yarns, Beam Warps and Machine Tools. Thos. Pray, Jr., 57 Weybosset st., Providence, R.I.

For Sale.—The Patent for Clothes Dryer, illustrated in SCIENTIFIC AMERICAN, Sept. 24, 1870. A. H. Patch, Hamilton, Mass.

Imp'd presses and dies for tin work; special drilling machinery for hardware manufacturers. Ferracute Machine Works, Bridgeton, N. J.

Cure for Drunkenness, sent by mail post-paid on receipt of 50 cts. Address Chas. W. Hall, M.D., New York city.

Rolling Mills at Auction.—Would call attention to advertisement in another column of sale of Rolling Mills at Baltimore. Rare chance for capitalists.

Wanted to purchase, a patent or arrange for the manufacture upon royalty of good and saleable articles or machines. The parties have shop, machinery, and capital. Address F. C. Beach, Stratford, Conn.

Nail Makers' Bead Grindstones. J. E. Mitchell, Philadelphia.

File Grinders' Grindstones. J. E. Mitchell, Philadelphia.

"Edson's Recording Steam Gage and Alarm," 91 Liberty st., New York. Illustrated in SCIENTIFIC AMERICAN, January 14, 1871.

Crampton's Imperial Laundry Soap, washes in hard or salt water, removes paint, tar, and grease spots, and, containing a large percentage of vegetable oil, is as agreeable as Castile soap for washing hands. "Grocers keep it." Office 84 Front st., New York.

Peck's Patent Drop Press. Milo Peck & Co., New Haven, Ct.

Millstone Dressing Diamond Machine—Simple, effective, durable. For description of the above see Scientific American, Nov. 27th, 1869. Also, Glazier's Diamonds. John Dickinson, 64 Nassau st., N. Y.

For small, soft, Gray Iron Castings, Japanned, Tinned, or Bronzed, address Enterprise Manufacturing Company, Philadelphia.

Situation Wanted by a Practical Draftsman. Best references given. C. Collins, 33 Nassau st., Newark N. J.

Thomson Road Steamers save 50 per cent over horses D. D. Williamson, 32 Broadway, New York.

Improved Foot Lathes. Many a reader of this paper has one of them. Selling in all parts of the country, Canada, Europe, etc. Catalogue free. N. H. Baldwin, Laconia, N. H.

E. Howard & Co., 15 Maiden Lane, New York, and 114 Tremont st., Boston, make the best Stem-winding Watch in the country. Ask for it at all the dealers.

The best place to get Working Models and parts is at T. B. Jeffery's, 160 South Water st., Chicago.

Scale.—Allen's Patent will remove scale from steam boilers, and not injure the iron. Send for Circulars. Josiah J. Allen, Philadelphia.

Building Felt (no tar) for inside and out. C. J. Fay, Camden, N.J.

Patent Elliptic-geared Punches and Shears.—The greatest economy of power, space, and labor. Can be seen in operation at our factory, in Trenton, N. J. Address American Saw Co., 1 Ferry st., New York.

Hand Screw Punches and Lever Punches. American Saw Co., New York.

Steel Stamp Alphabets, Figures, and Names. E. H. Payn, Burlington, Vt.

Self-testing Steam Gage—Will tell you if it is tampered with, or out of order. The only reliable gage. Send for circular. E. H. Ashcroft, Boston, Mass.

Glynn's Anti-Incrustator for Steam Boilers—The only reliable preventive. No foaming, and does not attack metals of boilers. Price 25 cents per lb. C. D. Fredricks, 587 Broadway, New York.

The Merriman Bolt Cutter—the best made. Send for circulars. Brown and Barnes, Fair Haven, Conn.

Manufacturers and Patentees.—Agencies for the Pacific Coast wanted by Nathan Joseph & Co., 619 Washington st., San Francisco, who are already acting for several firms in the United States and Europe, to whom they can give references.

To Cure a Cough, Cold, or Sore Throat, use Brown's Bronchial Troches.

Machinery for two 500-tun propellers, 60-Horse Locomotive Boiler, nearly new, for sale by Wm. D. Andrews & Bro., 414 Water st., N.Y.

Keuffel & Esser 116 Fulton st., N.Y., the best place to get 1st-class Drawing Materials, Swiss Instruments, and Rubber Triangles and Curves.

Cold Rolled-Shafting, piston rods, pump rods, Collins pat. double compression couplings, manufactured by Jones & Laughlins, Pittsburgh, Pa.

For mining, wrecking, pumping, drainage, and irrigating machinery, see advertisement of Andrews' Patents in another column.

House Planning.—Geo. J. Colby, Waterbury, Vt., offers information of value to all in planning a House. Send him your address.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Belting that is Belting.—Always send for the Best Philadelphia Oak-Tanned, to C. W. Arny, Manufacturer, 301 Cherry st., Phil'a.

For Fruit-Can Tools, Presses, Dies for all Metals, apply to Bliss & Williams, successor to May & Bliss, 118, 120, and 122 Plymouth st., Brooklyn, N.Y. Send for catalogue.

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## Answers to Correspondents.

*CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us: besides, as sometimes happens, we may prefer to address correspondents by mail.*

*SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal."*

*All reference to back numbers must be by volume and page.*

GALVANIZING GRAY IRON CASTINGS.—The following is a practicable way to "galvanize" (in other words to zinc) cast-iron articles, in answer to query No. 8, Jan. 1st: Cleanse the articles in an ordinary chafing mill, which consists of a barrel revolving on its axis; when the sand is all removed take them out and heat one by one, plunging while hot in a liquid composed as follows: 10 pounds of hydrochloric acid, sheet zinc, *q. s.* to make a saturated solution. In making this solution, when the evolution of gas has ceased, add muriate, or preferably sulphate of ammonia, 1 pound, and let it stand until dissolved. The castings should be so hot that when dipped into this solution, and instantly removed, they will immediately dry, leaving the surface crystallized like frost-work on a window pane. Next, plunge them while hot, but perfectly dry, into a bath of melted zinc, previously skimming the oxide on the surface away, and throwing thereon a small amount of powdered sal ammoniac. If the articles are very small, inclose them in a wrought-iron basket on a pole, and lower them into the metal. When this is done, shake off the superfluous metal, and cast them into a vessel of water to prevent them from adhering together when the zinc upon the surface solidifies.—I. T. P., of Ohio.

PERPETUAL MOTION SEEKERS.—We are in receipt of several letters from correspondents asking our opinion as to the practicability of their supposed self-moving devices. We pronounce them all failures, and take this summary way of disposing of their communications, as we cannot reply to each separately.

M. A. G., of Pa.—Kerosene lamp chimneys are often very imperfectly annealed. This is undoubtedly the cause of their unequal durability. Thin glass is not so liable to break from the effect of heat as thick glass, provided all other things are equal. The essential features of oil wells are the same as those of artesian wells sunk for water. The limits of penetration of the earth's crust are various, arising from the nature of materials, increasing weight of apparatus, etc. No exact depth can be stated as the extreme limit. Temperature has been found to increase regularly in penetrating the earth's crust. There are difficulties connected with measuring exactly the temperatures at the bottoms of such borings, the chief of which is the presence of water.

J. T., of Mass.—The effective surface of a surface condenser is that with which the steam comes in contact. The heating surface of flues and tubes is on that side with which the fire comes in contact. The reason for this is that the colder side of a plate of heated metal will conduct heat faster than the hotter side, which approximates more nearly to the temperature of the body from which the heat is derived, and, consequently, whether the hotter body be inside or outside the tubes or flues, the side remote from it will be capable of transmitting all the heat that can pass through the side directly exposed to heat.

D. J. B., of Texas.—To post yourself in the theory of locomotive engineering, get "Bourne's Works on the Steam Engine," published by D. Appleton & Co., New York, and "Auchincloss on Link and Valve Motions," published by D. Van Nostrand, also of New York.

M. M.—The effect of high pressure steam pipes on wood is discussed at length in Vol. XXI. of the SCIENTIFIC AMERICAN, page 145 and onward, in the course of which discussion you will find instances recorded of wood taking fire in contact with such pipes.

W. E. A., of Mich.—Oyster shells have been used to remove the incrustation from boilers in the same way as they remove the incrustation from teakettles when boiled in them. They will not, however, always succeed. It will do no harm to try them.

N. H. W.—No society, so far as we know, has ever offered a reward for the discovery of perpetual motion. No truly scientific person can be found who believes in this chimera.

F. X. M., of Fla.—We have no information upon the breeding of opossums. It is a subject that we have yet to investigate.

V. C., of N. Y.—We gave on page 400, last volume, all the information in our possession concerning the Heliade.

J. D. B., of Pa.—Your query was published in No. 2, current volume.

## Recent American and Foreign Patents.

*Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.*

STEAM GENERATING AND DISTILLING APPARATUS.—An error occurred in our announcement of this invention in our column of Recent American and Foreign Patents, in our issue of January 10, 1870. It should have read as follows:

Morris Wood, Chillicothe, Ill.—This invention relates to a new and useful improvement in an apparatus for generating steam for cooking food or other purposes, where steam at low pressure only is required, and also for distilling purposes.

FIRE ESCAPE.—E. J. Hudson, Golconda, Ill.—The object of this invention is to provide for the public an improved instrument for reaching the upper rooms of buildings on fire. To this end the invention consists in the employment of a device commonly known as a "lazy tongs" for elevating grappling hooks, ladders, etc., to the windows of the room to be entered, and in the employment, in connection therewith, of novel and effective appliances for guiding and controlling the lazy tongs, for enabling the workmen to use the device on uneven ground, and for steadying and supporting the apparatus when in use and transporting it from place to place.

SULKY CULTIVATOR.—H. P. Jordan, Victoria, Texas.—This invention has for its object to furnish an improved sulky cultivator which shall be simple in construction, easily operated, and effective in operation, giving the operator full control over the forward or inner plows, enabling crooked rows to be conveniently cultivated, and grass and weeds to be cut up close to the plants, or even between the hills of the row being cultivated.

PISTON.—A. H. Smith, M. D., New York city.—This invention has for its object to improve the construction of pistons in such a way that the packing can be tightened and loosened, as may be desired, without removing it from the barrel or cylinder or disturbing its connections, and which shall, at the same time, be simple in construction, effective in operation, and easily operated.

ANIMAL POWER.—O. M. Brock, Monroeton, Penn. This invention has for its object to furnish an improved power designed to be operated by a dog sheep, or other small animal, for operating a churn or driving other machinery, and which shall, at the same time, be simple in construction and convenient in use, being easily adjusted according to the weight of the animal that is to operate it.

CLARINET.—Anton Fritsche, New York city.—This invention has for its object to improve the arrangement of keys, levers, and the working mechanism on clarinets, so that the same may be played with less difficulty than the instruments now in use under the same name. The difficulties to be chiefly overcome consist in such a position of the keys on the old instruments that the fingers must at times be rocked on the instrument in order to change from one key to another, which is a very tiresome movement; also in such an arrangement of keys that certain trills or rapid changes must be produced by the little finger, which is easily tired; also in the insufficient arrangement of holes, whereby certain sounds cannot be produced with clearness and precision.

DRAWER.—R. J. Roberts, New York city.—This invention has for its object to improve the construction of drawers used in stores, warehouses, etc., so that the same may serve to display the goods of which they are the receptacles.

SPRING BOTTOM FOR WAGON BODIES.—Ephraim D. Cramer, Hackettstown N. J.—This invention relates to a new and useful improvement in wagon bodies, and consists in making a spring of the bottom of the body and attaching the seat thereto, or supporting the seat thereon, thus obviating the necessity for any other spring for rendering the seat elastic.

STOVE PIPE SHELF.—Samuel J. Anderson, Cazenovia, N. Y.—This invention has for its object to furnish a simple and convenient adjustable stove pipe shelf, and which shall be so constructed as to adapt it to various sized stove pipes.

BEDS, CUSHIONS, AND OTHER UPHOLSTERING.—Horace H. Barnes, Hoosick Falls, N. Y.—This invention has for its object to improve the construction of beds, mattresses, cushions, chair seats, car seats, and other upholstering, so as to ventilate the said articles allowing the air to pass through them freely.

GRAVEL AND SAND HEATER.—P. Le Goullon, Pittsburgh, Pa.—This invention has for its object to furnish an improved heater for heating gravel, sand, and similar substances, which shall be simple in construction, easily operated, and effective in operation, heating the material quickly and uniformly, and with a comparatively small amount of fuel.

MACHINE FOR PULPING WOOD, ETC.—George Sinclair, Edinburgh, Scotland.—This invention consists in constructing and arranging a boiler or vessel of a strong, close form, which can be heated only by the direct action, or radiation of the heat, from the flame and heated gaseous products of combustion from ordinary forms of fuel and furnaces, through the outer shell or case of the boiler.

VALVE GEAR.—William R. Reece, Tremont, Pa.—This invention has for its object to so construct the mechanism for operating a slide valve that the valve will be slowly closed, quickly opened, and allowed to remain stationary a short time, when closed, to fully utilize the force of the expanding steam.

PICTURE NAILS.—T. C. Richards, New York city.—This invention has for its object to improve the construction of porcelain-headed nails or spikes, such as are used for hanging pictures, mirrors, looping curtains, etc., so that the nails may be driven into the wall with the porcelain heads attached to them, instead of having the said porcelain heads detachable, in the manner heretofore practiced.

CAR COUPLING.—George H. Weeks, Allegan, Mich.—This invention has for its object to furnish a simple, strong, durable, and effective car coupling, which shall be so constructed as to couple the cars automatically, as they are run together, and which may be easily and conveniently uncoupled.

PROPELLER.—Edgar Eltinge and John C. Brodhead, Kingston, N. Y.—This invention has for its object to furnish an improved device for the propulsion of vessels, which shall be so constructed as to utilize a larger percentage of the power applied for the propulsion of the vessel than is possible with the paddle wheels and screws, as heretofore constructed and operated, and which shall at the same time be simple in construction.

STEAM GENERATOR.—Mirabeau N. Lynn, New Albany, Ind.—This invention relates to improvements in the construction of sectional vertical boilers of tubes, and consists in a square, circular, or other formed shell of tubes placed side by side, and connected at the ends to short large tubes, to form a figure corresponding in form to the cross section of the boiler to be made, part of the said tubes forming the shell being provided at the inside with circulating tubes connected to them at both ends, and projecting into the space above the fire, and the large transverse tubes at the ends being connected at the outside with return tubes for the promotion of the circulation by allowing the water to return to the bottom of the tubes forming the case; and the case being covered by a coil of feed-water and exhaust pipes, which protects it, and takes up and utilizes the heat given off by the shell.

HAMES.—Hugh B. Grumbling, Grant, Pa.—This invention relates to a new device for locking the lower ends of hames together, and to the collar, and also to a novel adjustable drafthook attachment for the same.

COTTON-SEED PLANTER AND GUANO DISTRIBUTOR.—William W. Croom, Montgomery, Ala.—This invention has for its object to furnish an improved machine for planting cotton seed and distributing guano, either or both and which shall be simple in construction, and effective and reliable in operation.

WASHING MACHINE.—A. Z. Young, Liberty, Miss.—This invention relates to improvements in washing machines, and it consists in a vertically working dasher at one end of a rectangular case, and a horizontally reciprocating dasher at the bottom, arranged in connection with a vibrating frame mounted horizontally on the case, so that the dashers will be worked against the clothes alternately, in a way to shift or turn them while beating them, in an efficient manner.

DENTAL LATHE.—Elias C. Rishel, White Haven, Pa.—This invention relates to improvements in dental lathes, and consists in an arrangement of the mandrel and the bearings therefor, to admit of readily removing the mandrel from the supports, as is often required for shifting or changing the wheels on the mandrel.

STOVE POLISH.—R. E. Cherrington, 8o. Boston, Mass.—This improved compound for stove blacking consists of glycerin and plumbago mixed to form a suitable paste for the purpose.

HAY PRESS.—F. F. Hamilton, Green Bay, Wis.—This invention relates to improvements in hay presses, and consists in an arrangement with the follower, of cords, guide rollers, and a winding drum for actuating it, by winding the cords on the drum, the said cords acting directly on the follower. It also consists in a combination with the case, the follower, and the operating cords, of a crane for raising the followers.

LIFTING JACK.—Orrin A. Anthony, Mayfield, N. Y.—This invention relates to improvements in portable apparatus for lifting and moving stones and other heavy bodies, and consists in a standard provided with a foot stand, a notched plate or other suitable device at the top for the reception of the upper end of a brace or shore to support it in a leaning position, on which post a notched lifting bar provided with hitching tackle is arranged, to be raised, held, or lowered, by a lifting pawl or clevis attached to the end of a working lever, and a holding pawl or clevis attached to the post.

MILL BUSH.—Hamlin F. Frisbie, Danville, Ill.—This invention relates to improvements in the bushes used in mill stones for supporting and lubricating the spindles, and consists in an arrangement, between the chambers for the bearings, of air ventilating passages for cooling the bearings and the spindles, also an arrangement of oil chambers in the bearings for containing oil and feeders therefor, and a mode of adjusting the bearings by wedges worked from below by screws with studs for turning them, accessible while the mill is running.

### APPLICATIONS FOR EXTENSION OF PATENTS.

MACHINERY FOR CLEANING AND SEPARATING COTTON, WOOL, FUR, AND OTHER FIBROUS MATERIALS.—Isaac Hayden, Lawrence, Mass., has petitioned for an extension of the above patent. Day of hearing, March 1, 1871.

WATER WHEELS.—Samuel Reynolds, Ellisburg, N. Y., has petitioned for an extension of the above patent. Day of hearing, March 8, 1871.

HARVESTING MACHINE.—George Esterly, Whitewater, Wis., has petitioned for the extension of the above patent. Day of hearing, March 8, 1871.

HARVESTER.—E. D. Buckman, Philadelphia, Pa., and Samuel A. Sisson Queensbury, Vt., executors of S. S. Allen, deceased, have petitioned for the extension of the above patent. Day of hearing, March 22, 1871.

HARROWS.—Sidney S. Hogle, Berea, Ohio, has petitioned for an extension o the above patent. Day of hearing, March 1, 1871.

STEAM BRAKES FOR RAILROAD CARS.—Theophilus E. Sickles, Omaha, Nebraska, has petitioned for an extension of the above patent. Day of hearin March 8, 1871.

## New Patent Law of 1870.

**INSTRUCTIONS**

HOW TO OBTAIN

# LETTERS-PATENT

FOR

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## NEW BOOKS AND PUBLICATIONS.

ELEMENTS OF CONSTRUCTION AND DRAWING, OR MACHINE DRAWING. With some Elements of Descriptive and Rational Cinematics. A Text-book for Schools of Civil and Mechanical Engineering, and for the Use of Mechanical Establishments, Artisans, and Inventors. Containing the Principles of Gearing, Screw Propellers, Valve-motions, and Governors; and many Standard and Novel Examples, mostly from American Practice. By Edward Warren, C.E., Professor in the Rensselaer Polytechnic Institute, and author of a series of works on Descriptive Geometry and Stereotomy. New York: John Wiley & Son, No. 15 Astor Place.

This is an excellent work by a well-known and justly esteemed author. It is rather too technical in its method for the majority of mechanical readers, but is admirably adapted to use as a text-book in a thorough course of engineering study. The plates are bound in a volume by themselves, a plan to be commended; the old method of folded plates, interspersed through the text or placed at the end of the work, being very inconvenient.

ON THE USES OF WINES IN HEALTH AND DISEASE. By Francis E. Anstie, M.D., F.R.C.P., Editor of the London *Practitioner*, assisted by the Editorial Staff. New York: J. S. Redfield, Publisher, No. 140 Fulton street.

NATURAL HISTORY. By Adrian J. Ebell, Ph.B., M.D. Part I. A Text-book extending to a History of Classes among Animals. Price, Fifty cents. Ebell & Co., Publishers of School and Popular Works, Room No. 18, Cooper Union Building, New York.

THE SECRETS OF THE ART OF DYEING WOOL, COTTON, AND LINEN. Including Bleaching and Coloring Wool and Cotton Hosiery, and Random Yarns. A Treatise based on Economy and Practice. By E. C. Haserick. Cambridge: Welch, Bigelow & Co., Printers to the University. Dr. J. B. Thompson, No. 45 Broadway, New York city, is the Agent for New York, Pennsylvania, Connecticut, Rhode Island, and New Jersey; and Charles C. Badlam, No. 23 Kilby street, Boston, is Agent for Massachusetts, Maine, New Hampshire, Vermont, the Western and Southern States, and Canada.

The above work is sold by subscription, and information will be given or subscriptions received by the agents named above. The work has been prepared by a practical dyer of thirty-six years' experience, whose communications have more than once enriched the correspondence columns of this journal. It is written in the plainest style, and its formulæ are expressed in the clearest language, so that there need be no mistake. Each recipe is accompanied with a sample of the color designed to be produced, on a specimen of yarn or cloth, handsomely mounted and numbered for reference. The work is one of the most important technical treatises ever issued in this country, and must meet with a large sale.

## Official List of Patents.

### ISSUED BY THE U. S. PATENT OFFICE.

FOR THE WEEK ENDING JAN. 10, 1871.

*Reported Officially for the Scientific American.*

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**MUNN & CO.,**
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110,815.—GLASS LAMP.—John Adams, Birmingham, Pa.
110,816.—LAMP.—Albert Albertson, Jersey City, N. J. Antedated Dec. 30, 1870.
110,817.—STOVE-PIPE SHELF.—S. J. Anderson, Cazenovia, N.J.
110,818.—LIFTING JACK.—O. A. Anthony, Mayfield, N. Y.
110,819.—CASE FOR REED ORGANS.—C. E. Bacon, Buffalo, N. Y.
110,820.—BED, CUSHION, AND OTHER UPHOLSTERING.—H. H. Barnes, Hoosick Falls, N. Y.
110,821.—ADJUSTABLE DOOR FASTENER.—L. P. Barnes, Fitchburg, Mass.
110,822.—MACHINE FOR DRILLING SHUTTLES.—C. E. Billings, Hartford, Conn.
110,823.—ADJUSTABLE LOCK COUPLING FOR VEHICLES.—G. G. Burgess, Grafton, Ohio.
110,824.—COMPOUND FOR STOVE POLISH.—R. E. Cherrington, South Boston, Mass.
110,825.—WASHING MACHINE.—S. J. Clark, Richmond, Ind.
110,826.—INSULATED BOLT FOR RAILWAY RAILS.—J. W. Cochran, New York city.
110,827.—MARINERS' SOUND INDICATOR.—Jas. Cochrane, N.Y.
110,828.—RUBBER PAD FOR HORSE SHOES.—D. L. Corbin, Friendship, N. Y.
110,829.—SELF-ACTING SEWER-BASIN TRAP.—M. K. Couzens, Yonkers, N. Y.
110,830.—SPRING BOTTOM FOR WAGON BODIES.—E. D. Cramer, Hackettstown, N. J.
110,831.—WASHING MACHINE.—A. O. Crane, Boston, Mass.
110,832.—COTTON-SEED PLANTER AND GUANO DISTRIBUTOR. W. W. Croom, Montgomery, Ala.
110,833.—MANUFACTURE OF ARTICLES FROM PAPER PULP.—Francis Curtis (assignor to David Scrymgeour), Foxborough, Mass.
110,834.—FEED CUTTER.—William Dahlem, Madison, Ind.
110,835.—STEAM-ENGINE VALVE.—C. P. Deane, Springfield, Mass.
110,836.—CULTIVATOR.—W. A. Dryden (assignor to himself and J. M. Turnbull), Monmouth, Ill.
110,837.—CORN PLANTER.—Y. I. Edwards, Trenton, Tenn.
110,838.—VENTILATOR.—William Ennis, New York city.
110,839.—DRIVE SCREW.—D. F. Fetter, New York city.
110,840.—SHOE.—J. W. Fisher, Albany, N. Y.
110,841.—BINDING ATTACHMENT FOR HARVESTERS.—Abraham Freed and Jonathan Snook, La Porte, Ind. Antedated Jan. 7, 1871.
110,842.—CONNECTING ROD.—W. G. Freeman, Richmond, Va.
110,843.—MILL BUSH.—H. F. Frisbie, Danville, Ill.
110,844.—FIRE SCREEN AND STAND.—Hugo O. Fritsch, New York city.
110,845.—CLARIONET.—Anton Fritsche, New York city.
110,846.—LAMP BURNER.—Geo. P. Fuller, Humphrey, N. Y. Antedated December 30, 1870.
110,847.—HIDE-WORKING MACHINE.—M. B. Gould (assignor to himself and W. L. Shaw), Buffalo, N. Y. Antedated December 29, 1870.
110,848.—HAMES FASTENING.—Hugh B. Grumling, Grant, Pa. Antedated January 6, 1871.
110,849.—HAY PRESS.—Finlay F. Hamilton, Green Bay, Wis.
110,850.—STEAM PUMP.—Thomas Harrington, Pittsburgh, Pa.
110,851.—FIRE ESCAPE.—Edward J. Hudson, Golconda, Ill.
110,852.—ARTIFICIAL STONE FOR PAVEMENTS, WALKS, FLOORS, ETC.—Carleton B. Hutchins, Ann Arbor, Mich.
110,853.—SULKY CULTIVATOR.—Hugh P. Jordan, Victoria, Texas.
110,854.—BED BOTTOM.—William B. Judson (assignor to J. P. Nelson, Jr.), Poughkeepsie, N. Y.
110,855.—NEEDLE SETTER AND THREADER FOR SEWING MACHINES.—Jacob Karr, Washington, D. C.
110,856.—DEVICE FOR SECURING THE TINES OF HAY TEDDERS.—Delancy Kennedy, New York city.
110,857.—APPARATUS FOR GENERATING AND BURNING VAPOR FROM HYDROCARBONS.—Joshua Kidd, New York city.
110,858.—ROLLER SKATE.—Matthew H. Kimball (assignor to himself and James Garvey), San Francisco, Cal.
110,859.—ROOFING TILE PRESS.—John Koehler, Warren, Ohio.—Antedated December 6, 1870.
110,860.—PLOWSHARE.—John Lane (assignor to Hapgood & Co.), Chicago, Ill.
110,861.—GRAVEL AND SAND HEATER.—Philip Le Goullon, Pittsburgh, Pa.
110,862.—STEAM GENERATOR.—Mirabeau N. Lynn, New Albany, Ind.
110,863.—CARRIAGE-CURTAIN FASTENER.—Wm. H. Morse, West Newbury, Mass.
110,864.—HAND STAMP.—Marcus P. Norton (assignor to Helen M. Ingalls), Troy, N. Y.
110,865.—TRACTION ENGINE.—Treat T. Prosser (assignor to himself, Henry Waller, and W. S. Waller), Chicago, Ill.
110,866.—APPARATUS FOR SUPPLYING NAPHTHA TO VAPOR-BURNING STREET-LAMPS.—Frances M. Randall, Greenburg, N. Y.
110,867.—PICTURE NAIL.—Thomas C. Richards, New York city.
110,868.—LUBRICATOR.—Joseph Richter, Cincinnati, Ohio.
110,869.—DENTAL LATHE.—Elias C. Rishel, White Haven, Pa. Antedated December 31, 1870.
110,870.—DRAWER FOR STORES.—Robert Jordan Roberts, New York city.
110,871.—LATHE FOR TURNING WOOD.—Ira Rood, Elyria, Ohio.
110,872.—MAN-HOLE PLATE FOR STEAM BOILERS.—John D. Samson, Peoria, Ill.
110,873.—APPARATUS FOR BOILING AND TREATING PAPER STOCK.—George Sinclair, Leith, Scotland.
110,874.—PISTON.—Andrew H. Smith, New York city.
110,875.—CEREMONIAL BELL.—John W. Smith, Keokuk, Iowa.
110,876.—HORSE HAY RAKE.—Joshua C. Stoddard, Worcester, Mass.
110,877.—LIQUID METER.—William G. Stuart, Chicopee, Mass.
110,878.—METHOD OF COATING SAD IRONS, ETC.—William H. Towers, Boston, Mass.
110,879.—TRIMBLE.—Edward B. Towle, Newburyport, Mass.
110,880.—CAR COUPLING.—George H. Weeks, Allegan, Mich.
110,881.—METALLIC CARTRIDGE.—Rollin White, Lowell, Mass.
110,882.—CURBING FOR EXCAVATIONS.—Henry Whitestone, Louisville, Ky.
110,883.—FASTENING FOR THE TIPS OF BILLIARD CUES.—Oliver C. Wilbur, Jr., Providence, R. I.
110,884.—BOILER FOR HEATING.—John G. Wilson, New York city.
110,885.—WASHING MACHINE.—Ananias Z. ng, Liberty, Miss.
110,886.—SNOW SHOVEL.—Albert Q. Adams, Wallingford, Vt.
110,887.—CHARGER FOR SHOT POUCHES.—Thomas W. Allen, Waterbury, Conn.
110,888.—FENCE.—Collester M. Ballard and Myron Morehouse, Johnsonburg, N.Y.
110,889.—HOT-AIR FURNACE.—William D. Bartlett, Amesbury, Mass.
110,890.—SPARK ARRESTER.—Darwin Beach, Oshkosh, Wis.
110,891.—EMBOSSING HAT LININGS.—Thomas W. Bracher, New York city.
110,892.—ANIMAL POWER APPARATUS.—Orville M. Brock (assignor to James H. Hawes and George Hawes), Monroeton, Pa.
110,893.—HAY TEDDER.—Alzirus Brown, Worcester, Mass.
110,894.—BEE HIVE.—Gustavus Adolphus Brown and Francis Adams McCallen, Russellville, Ky.
110,895.—FLUTING MACHINE.—Abner Burbank, Rochester, N.Y.
110,896.—GRAIN DRIER.—Lewis S. Chichester, Brooklyn, N.Y.
110,897.—CHURN.—Jacob Clark, Brush Valley, Pa.
110,898.—VENTILATOR OR BLOWER.—John F. Collins, New York city.
110,899.—FENCE.—Thomas C. Collins, Little Hockhocking, Ohio.
110,900.—PARLOR ORGAN.—James Cordley, Adrian, Mich.
110,901.—RAILWAY-CAR PLATFORM.—Rensselaer A. Cowell, Cleveland, Ohio.
110,902.—CHURN.—John Cram (assignor to himself and John S. Cram), Chicago, Ill.
110,903.—LATHE CHUCK.—Austin F. Cushman, Hartford, Conn.
110,904.—LOOM.—Hilas D. Davis, North Andover, Mass.
110,905.—VENTILATOR.—Edward Mortimer Deey, New York city.
110,906.—RAILROAD-CAR VENTILATOR.—John M. Dexter, Elmira, N.Y.
110,907.—APPARATUS FOR DYEING FABRICS.—Thomas Messenger Drown (assignor to W. A. Drown), Philadelphia, Pa.
110,908.—PROPELLER.—Edgar Eltinge and John C. Brodhead, Kingston, N.Y.
110,909.—BEE HIVE.—Thomas S. Engledow, Cedar Falls, Iowa.
110,910.—FENCE.—Admiral Faulkner, Mount Pleasant, Iowa.
110,911.—SHAFT TUG.—Kasson Frazer, Syracuse, N. Y.
110,912.—ROTARY ENGINE.—Samuel Gibson, Lancaster, assignor to himself and Alexander L. Hayes, Lancaster, and J. W. G. Wierman, York, Pa.
110,913.—SHUTTER FASTENER.—Ebenezer A. Goodes, Philadelphia, Pa.
110,914.—WRENCH.—John Goodin, Joliet, Ill.
110,915.—AIR ENGINE OR FAN BLOWER.—Gardner C. Hawkins, Boston, Mass.
110,916.—COFFEE ROASTER.—Louis Houcke, Springfield, Ohio.
110,917.—BROOM HOLDER.—Zadok Howe, Lowell, Mich.
110,918.—JOINT FOR FRAMES OF FOLDING UMBRELLAS.—Algernon S. Hubbell, Norwich, Conn.
110,919.—SAD IRON.—Hubert R. Ives, New Haven, Conn.
110,920.—AUGER HANDLE.—William A. Ives, New Haven, Conn.
110,921.—HAT.—Jeremiah Keith, Charlton, Mass.
110,922.—STREET LAMP.—John F. Kerns, Baltimore, Md.
110,923.—LOUNGE.—Oswald Kubitschky, Chicago, Ill.
110,924.—PLOW.—John M. Leonard, Marshall, Mich.
110,925.—BILLIARD TABLE.—William Lochhead, Brooklyn, N.Y.
110,926.—SLIDING STOP VALVE.—Henry G. Ludlow, 2d (assignor to Ludlow Valve Manufacturing Company), Troy, N.Y.
110,927.—GRINDING MILL.—Isaac Mayfield and William D. Mayfield, Mayfield, Ky.
110,928.—REGULATING THE DISCHARGE OF WATER FROM PUMPS.—John Mayher, East Hampton, Mass.
110,929.—ROTARY BLOWER.—Henry C. McIlwain and Alonzo Brumfiel, Connersville, Ind.
110,930.—VALVE FOR OIL PUMPS.—Henry Millingar, Pittsburgh, Pa. Antedated Dec. 30, 1870.
110,931.—CRADLE.—Albert H. Ordway, Haverhill, Mass.
110,932.—NECK YOKE OF HARNESS.—Albert Parliman, Palmyra, N. Y.
110,933.—STEAM VACUUM PUMP.—James H. Pattee and H. J. Graham, Monmouth, Ill.
110,934.—SPRING FOR WAGONS AND CARRIAGES.—Samuel J. Pearsall and Silas P. Briggs, Saratoga Springs, N. Y.
110,935.—VALVE GEAR.—Wm. R. Reece (assignor to himself and "The Iron Manufacturing and Coal Co."), Tremont, Pa.
110,936.—PUMP.—N. P. Sheldon, San Francisco, (assignor to himself and Wm. H. Hall, San José, Cal.
110,937.—BEEHIVE.—Luther S. Sisson, West Edmeston, N. Y.
110,938.—UNIVERSAL COG-WHEEL COUPLING.—Egbert Smith (assignor to himself and Martin Sherrick), Adams County, Ill.
110,939.—CURTAIN FIXTURE.—William H. Tambling, Eleroy, Ill.
110,940.—PIANO.—William F. Ulman, Boston, Mass.
110,941.—BOOK-CASE FOR SCHOOLS, ETC.—Peter T. Vannice, Kewanee, Ill.
110,942.—VESSEL FOR CARRYING LIQUID CARGOES.—Wm. G. Warden, Philadelphia, Pa.
110,943.—CUT-OFF FOR STEAM ENGINES.—William Watts and F. A. Phelps, Newark, N. J.
110,944.—MACHINE FOR BOARDING LEATHER.—Urban R. Williams and W. P. Martin, Salem, Mass.
110,945.—PRESSER AND STITCH DIVIDER FOR SEWING MACHINES.—Alfred S. Woodward, New York city.
110,946.—APPARATUS FOR PROCESSES FOR GENERATING AND BURNING VAPOR FUEL.—Alfred J. Works, New York city, and Henry A. Daniels, Washington, D. C., assignors to the United States Vapor-Fuel Co., New York city.
110,947.—PAPER-POLISHING MACHINE.—Abram Wright and George F. Wright (assignors to themselves and J. H. McNabb), Clinton, Mass.

### REISSUES.

4,230.—DEVICE FOR BAKING BREAD.—Abram I. Quackenbush and Guilford Hawn, Fort Plain, N. Y.—Patent No. 99,109, dated January 25, 1870.
4,231.—CULTIVATOR.—Benjamin Tinkham, Cameron, assignor to Hapgood & Co., Chicago, Ill.—Patent No. 30,897, dated December 11, 1860.

### DESIGNS.

4,563.—TYPE.—Andrew Gilbert, Boston, Mass.
4,564.—COAL HOD.—Christian Linder, Nauffen, Wurtemberg.
4,565.—SOLDIER'S MONUMENT.—Lewis A. Tifft, Springfield, Mass.
4,566.—COMBINED PENCIL AND RECEIPTACLE.—Horace J. Wickham, Manchester, Conn., assignor to Joseph Reckendorfer, New York city.

### TRADE-MARKS.

128.—PAINT.—Averill Chemical Paint Co., New York city and Cleveland, Ohio.
129.—LIQUID CHEMICAL PAINT.—Averill Chemical Paint Co., New York city and Cleveland, Ohio.
130.—CHEMICAL PAINT.—Averill Chemical Paint Co., New York city and Cleveland, Ohio.
131.—AGRICULTURAL FORKS.—Batcheller Manufacturing Co., New York city.
132.—CARPETS.—Lowell Manufacturing Co., Lowell, Mass.
133.—STEAM ENGINE.—Joel Sharp, Salem, Ohio.
134.—FRINGES, RIBBONS, AND TRIMMINGS OF SILK.—Silbermann, Heinemann & Co., New York city.


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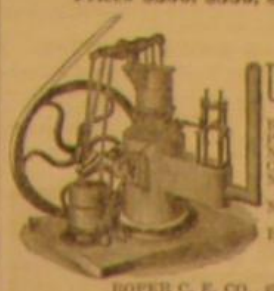

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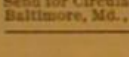

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