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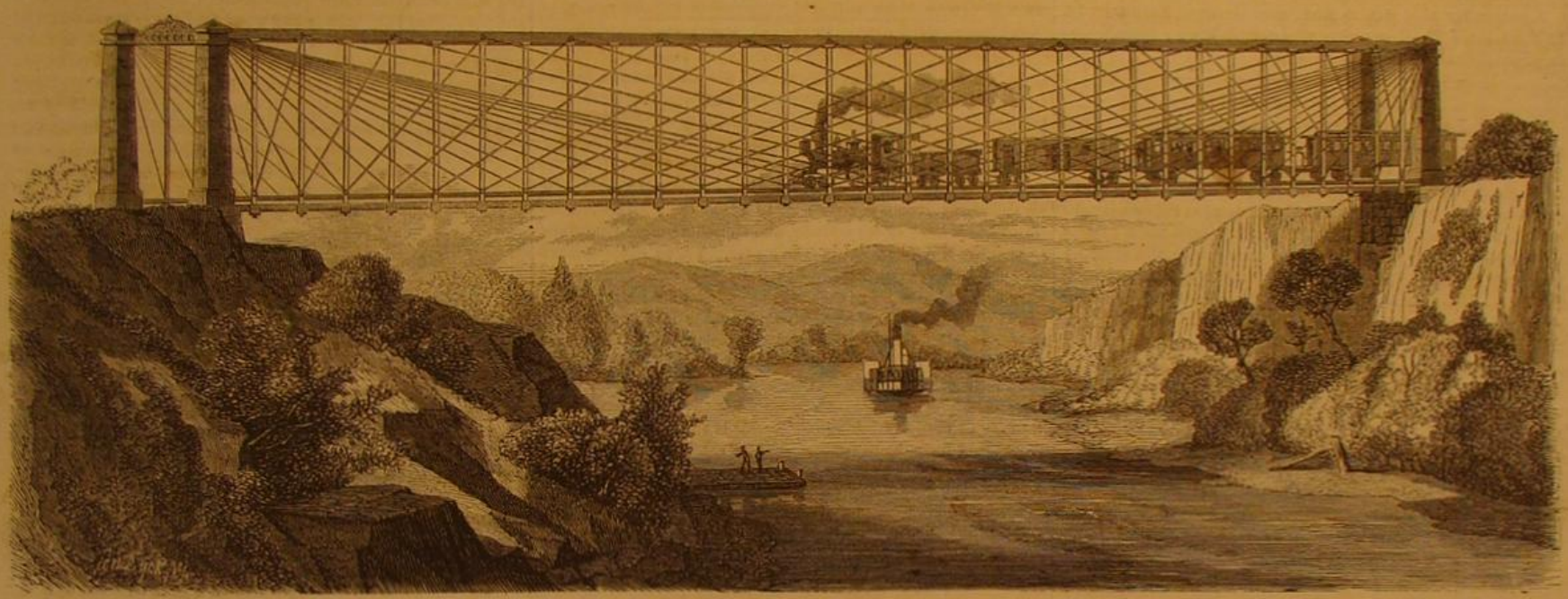
Suspension Truss Bridge.

Our engravings illustrate a light and graceful bridge, invented by Mr. John H. Diedrichs, an engineer well known to the scientific world by his valuable work on the theory of strains. His object was to produce a suspension truss for bridges which should be durable and economical in construction, and should secure from a given quantity of material a greater proportion of strength than is derived in any other truss system. This is accomplished principally by a novel and judicious distribution of the tie rods which connect the lower ends of the pendent posts with the top chord of the bridge.



DIEDRICHS' SUSPENSION TRUSS BRIDGE.

Fig. 1 shows the arrangement of these parts, which the following description will explain:

From the top chord of the bridge, which is properly supported on the buttresses, are suspended posts at suitable distances from each other, but of which posts there should be an uneven number pendent from every top chord. Tie rods or braces connect the lower ends of these posts with the buttresses and top chord; and these tie rods are applied in the following manner: From the lower end of each post, project two tie rods in opposite directions, bent at equal angles, one

Fig. 2

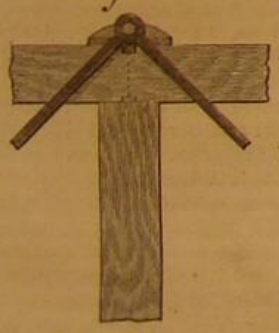


Fig. 3

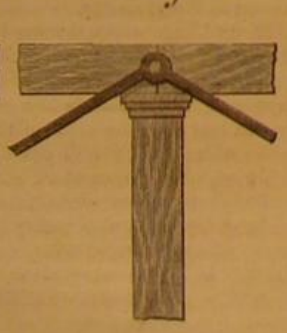


Fig. 4

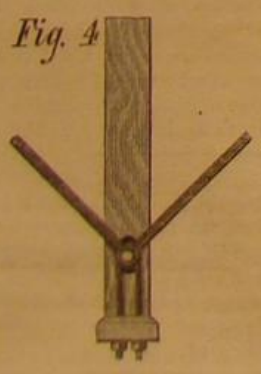
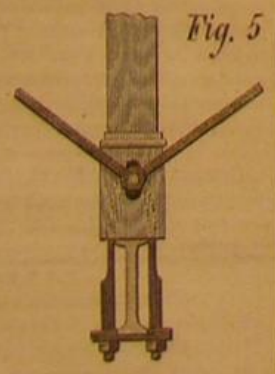


Fig. 5



of which is continued to the nearest buttress, the other to the juncture of a post with the top chord. By this means every post is connected with one buttress only, but the middle post, which is united to both. At the upper ends, only every alternate post is braced, provided they are equidistant, which arrangement is preferable in practice. The top chords and posts may be made of wood or metal. In the first case, the upper ends of the tie rods are secured, where they join, to boxes placed upon the top chord, as shown in Fig. 2. In the second, the connection may be made directly to the metallic top chord, as shown in Figs. 1 and 3. The lower ends of the tie rods, where they project from the post, are united by a bolt passing through a vertical slot in the post. A strap is laid round the bolt in the slot, and its two ends passed through a plate at the bottom of the post and secured by nuts, as shown in Fig. 4. By this mode of fastening, the tie rods are made adjustable as to their length, and the tension on them can be regulated with extreme nicety. Fig. 5 shows an elongated form of strap adapted to the support of transverse beams below the posts.

The contraction and expansion consequent on changes of temperature cannot give rise to undue strain on the parts of this bridge, as the tie rods projecting from each post are of equal lengths. A lateral shifting of the connecting pins from the above causes is also rendered impossible, which is a feature of great importance. The system admits of the use of equally thick rods throughout bridges of considerable length, though the rods nearest the middle may be made somewhat thicker than the others. The peculiar distribution of the tie rods relieves the top chord of excessive strain, and the special bracing of panels is rendered unnecessary, while the general appearance secured is light and harmonious.

The improvement was patented through the Scientific American Patent Agency, April 2, 1872. For further information address John H. Diedrichs, care of Mr. C. Gewecke, 115 North Front street, Baltimore, Md.

Powdered Coal for Unhealthy Plants.

In a communication, addressed to the *Revue Horticole*, the writer states that he purchased a very fine rosebush, full of buds, and, after anxiously awaiting their maturing, was greatly disappointed, when this took place, to find the flowers small, insignificant in appearance, and of a dull, faded color. Incited by the suggestion of a friend, he then tried the experiment of filling in the top of the pot, around the bush, to the depth of half an inch, with finely pulverized stone coal. In the course of a few days, he was astonished at seeing the roses assume a beautiful red hue, as brilliant and lively as he could desire.

He tried the same experiment upon a pot of petunias, and soon after, all the pale and indefinite colored ones became of a bright red or lilac, and the white petunias were variegated with beautiful red stripes. Some of the lilac petunias became a fine dark blue. Other flowers experienced similar alterations; those of a yellow color alone remained insensible to the influence of the coal.

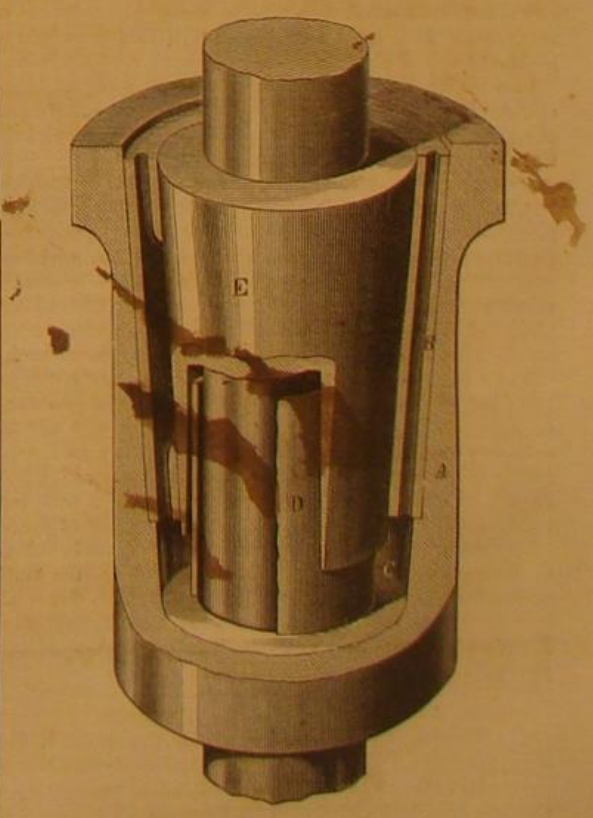
Railway Torpedoes.

A neat and effective device for securing convenience and safety in railroad operations is the "torpedo" or alarm signals. This little affair consists of a tin box about the size and shape of the smallest sized blacking boxes. The box is filled with an explosive compound, and two strips of tin are soldered to two opposite sides of the box, perpendicular to its sides or edges, for fastening it to the rail. These boxes explode on the principal of the percussion cap, with a loud report. They are in use on some roads for night signals and in foggy weather, when lights or flags would not be seen in time to prevent accident. Track men are provided with these torpedoes, and in case of danger they are placed on the rail, far enough from the place of danger to prevent disaster. Usually three of them are placed, a few feet apart, to insure their being heard by the engineer. They are reliable, and will explode at the touch of the wheel at the slowest speed.

It is said that the Reading company uses 35,000 of these torpedoes per annum on the roads which it operates. This is a good showing in favor of the contrivance, and doubtless many serious accidents are prevented by their use. They cost but a trifle. The Reading company is always ready to adopt good improvements. Some genius might do a good thing by contriving a plan by which a torpedo could be placed on the rail at drawbridges and switches in case of misplacement.

SELF-LUBRICATING BOX AND SHAFT BEARING.

In this invention, centrifugal force is utilized for the purpose of lubricating upright bearings. Our engraving shows the several parts of the device, partly in sections and partly in perspective. A is the outer shell of the box, which is lined with the composition metal, B. Through this lining up



right passages are made, as shown in the engraving, extending from the circular oil chamber, C, to the top of the box. D is a sleeve which projects upwards from the bottom of the box around the shaft and forms the inner wall of the oil chamber. It does not touch the shaft. Projecting downward over the sleeve into the oil chamber is an enlargement of the shaft shown at E. It is so chambered out as to admit the sleeve without touching it. This enlargement is turned so as to form a taper bearing, larger at the top than at the bottom, as shown.

The operation is as follows: The rotating shaft carries with it the enlargement, E, and produces centrifugal force in the oil chamber, by which the oil is driven up the passages in the lining, B, and through apertures therein to the sides of the bearing. The same force also carries up the oil between the bearing and the lining to the top of the box. Surplus oil at the top is returned by the passages to the oil chamber, into which the drippings from the bearing fall. The bearing is thus made to move constantly in oil, and when running at considerable speed never comes in contact with the box, as the centrifugal force developed is sufficient to keep a sheet of oil always between them under any ordinary pressure on one side of the shaft. This has been proved in practice; and shafts fitted on this principle, and rotating 4,500 times per minute, have run for fourteen months without sensible wear of the box or need of readjustment. They can be run for months without re-oiling, as, by the construction, no oil can escape, and it must consequently be all used up.

A patent for this device has been granted, February 13, 1872, to Mr. J. P. Grosvenor, of Lowell, Mass., from whom further information may be obtained.

Cholera and Sun Spots.

Mr. B. G. Jenkins recently read, before the Historical Society of London, a remarkable paper on cholera, in which he maintained that the disease is intimately connected with auroral displays and with solar disturbances. "I believe that I am able to show that a remarkable connection exists between the maxima and the minima of cholera epidemics and of solar spots. You are all probably aware that the great astronomer Schwabe discovered that the sun spots have what is called a ten year period; that is, there is a minimum of spots every ten years. It was also discovered that the diurnal variation in the amount of declination of the magnetic needle has a ten year period. The same was proved in regard to earth currents, and also auroræ. The maxima and minima of the four were found to be contemporaneous. This was a great result; but Professor Wolf, on tabulating all the sun spots from the year 1611, discovered that the period was not ten years, but 11·11 years. This period is now the accepted one for the sun spots, and it has been established for the magnetic declination, and by Wolf for the auroræ. Now, it is a curious fact that the last year of every century, as 1800, has a minimum of sun spots, so that the minima are 1800, 1811·11, 1822·22, 1833·33, etc. The maxima do not lie midway between the minima, but anticipate it by falling on the year 4·77 after a minimum; for example, 1800 was a minimum year, then 1804·77 was a maximum year. Now, cholera epidemics have, I belive, a period equal to a period and a half of sun spots. Reckoning then from 1800, we get as a period and a half the date 1816·66, which was shortly before the great Indian outbreak; another period and a half gives 1833·33, a year in which there was a maximum of cholera; another, 1849·99, that is, 1850, a year having a maximum of cholera; another, 1866·66, a year having a maximum of cholera; another, 1883·33, as the year in which there will be a cholera maximum. It follows from what has been already said that 1783·33 would be a year in which cholera was at a maximum. Now it is a fact that in April 1783 there was a great outbreak of the disease at Hurdwar.

I am not, however, prepared to say that sun spots originate cholera; for they may both be the effects of some other cause, which may indeed be the action of the other planets upon the earth and upon the sun.

My own opinion, derived from an investigation of the subject, is that each planet, in coming to and in going from perihelion—more especially about the time of the equinoxes—produces a violent action upon the sun, and has a violent sympathetic action produced within itself—internally manifested by earthquakes, and externally by auroral displays and volcanic eruptions, such as that of Vesuvius at the present moment; in fact, just such an action as develops the tail of a comet when it is coming to and going from perihelion; and when two or more planets happen to be coming to or going from perihelion at the same time, and are in, or nearly in, the same line with the sun—being, of course, nearly in the same plane—the combined violent action produces a maximum of sun spots, and in connection with it a maximum of cholera on the earth. The number of deaths from cholera in any year—for example, the deaths in Calcutta during the six years 1865 70—increased as the earth passed from perihelion, especially after March 21, came to a minimum when it was in aphelion, and increased again when it passed to perihelion, and notably after equinoctial day; thus affording a fair test of my theory."

American Sailors as Firemen.

The American squadron, consisting of the *Wabash*, *Congress*, *Brooklyn*, *Plymouth*, *Shenandoah*, *Juniata* and *Wachusette*, under the command of Admiral Alden, recently lay in the Napoleon Basin, at Marseilles, France, amid innumerable merchantmen of every description and from every nation. Shortly after midnight, an explosion startled the city, followed by fire and dense clouds of heavy smoke which issued from an Italian ship just arrived from Philadelphia with a cargo of petroleum. The nature of the danger soon became evident, and it seemed impossible to prevent the spreading of the fire from ship to ship, as they lay in such a mass, and a general conflagration seemed imminent, for the houses extend down to the wharf on every side. No city of France has the means to extinguish a great fire, and hence the people gathered, contemplating the scene in panic stricken, fascinated horror.

Presently a well manned boat came from the part of the basin illuminated by the blaze and pulled directly toward the burning ship. This was soon followed by another, then a third, ten, twenty, all the boats of the American squadron. A moment later men were seen on the deck of the burning ship. The silence of the people on the shore was such that they could hear, through the smothered roar and crackle of the fire, the word of command and blows of axes. The people are thinking of the hundreds of barrels of petroleum below and its possible escape on shore and communication to other ships, perhaps others with petroleum, and in imagination conceived the whole surface of the basin covered with blazing oil. Presently the burning vessel began to settle. She had been scuttled, and her cargo was now under water, the deck being level with the surface. The danger from the escape of burning petroleum was still imminent when a line of boats, lashed together stem and stern, was seen pulling away, and as the file straightened out the burning ship moved also, and was slowly towed out to the bay by over two hundred well manned oars. It was only then that an immense cheer broke from the thousands of people, who felt inexpressible gratitude for the salvation of the city.

The Steam Jet Air Exhaust.

At a recent meeting of the Institute of Mechanical Engineers, London, the President, C. W. Siemens, read a paper "On a Steam Jet for Exhausting Air, etc., and the Results of its Application." The form and application of the steam jet having remained hitherto essentially the same as in the original steam blast of the locomotive, it occurred to the writer that much might be done to improve its effect by a judicious arrangement of the parts, so as to avoid eddies in the combined current of steam and air, and to utilize more completely the initial momentum of the steam. These objects have now been effectually accomplished by the employment of a very thin annular jet of steam in the form of a hollow cylindrical column discharged from an annular nozzle. The air to be propelled by the steam jet is admitted through an exterior annular orifice surrounding the jet, and also through the center of the hollow jet; and the area of the air passages is gradually contracted on approaching the jet, whereby the velocity of motion of the entering air is so much accelerated before it is brought in contact with the steam as to avoid the great difference in the velocity of the two currents at the point where they come together, which caused the eddies that previously impaired the efficiency of the steam jet. By the annular form of the steam jet, the extent of surface contact between the steam and the air is greatly increased and the quantity of air delivered is by this means very much augmented in proportion to the quantity of steam employed. The combined jet of steam and air is discharged through an expanding delivery pipe of considerable length, in which its velocity is gradually reduced and its momentum accordingly utilized by being converted into pressure.

This improved steam jet has been applied for exhausting one of the pneumatic despatch tubes employed at the Central Telegraph Station, in London, for conveying the carriers containing telegraphic despatches from one station to another. The result of a comparative trial made with the steam jet and with a good steam engine and exhausting pump has been found to be that the expenditure of steam is about the same in the two cases in doing the same work, the advantages of the steam jet being its very low first cost in comparison with that of the engine and pump, and also its great simplicity, and the small space occupied as compared with an engine and pump.

Another application of the steam jet is to the lifting of water from a moderate depth, by employing the jet to exhaust the air from a closed vessel, into which the water then rises under the pressure of the atmosphere, the hight of lift depending upon the size of the jet and the pressure of steam, and the consequent degree of vacuum obtained in the vessel. The discharge from the steam jet, being then admitted into the top of the vessel, allows the water to escape through a delivery valve in the bottom and aids in its expulsion. By using a pair of these vessels in conjunction, and putting the exhausting jet in communication with each alternately, by means of a self acting float and reversing valve, one vessel is filling while the other is discharging, and a continuous delivery of water is thus obtained.

It is also proposed to apply the steam jet for exhausting the vacuum pans employed in sugar boiling, so as to dispense with the present costly vacuum pumps and steam engine and the condenser for condensing the vapor from the evaporating pan; the supply of condensing water, which in many places in the sugar growing colonies is a consideration of vital importance, will thus be rendered unnecessary. The steam jet is further expected to prove very useful for draining the molasses from the sugar, by exhausting the air from below the perforated bottom of a strainer containing the undrained sugar, whereby the present modes of draining by gravitation or by centrifugal strainers can be superseded with advantage.

Numerous applications have been made of the steam jet as a blower for accelerating the distillation of fuel in gas producers for heating purposes, the jet being admitted into the space underneath the fire grate, which is enclosed by doors. By this means it is found that coal dust of the most inferior description may be used, and the rate of production of the gas is doubled, while at the same time its quality is improved, owing to the generation of hydrogen from the steam which enters intermingled with the air.

A specimen was exhibited of the steam jet apparatus; and the particulars were given of the proportions which have been found by experiment to be attended with the greatest efficiency, rendering the jet capable of realizing results comparable with those obtained from a steam engine working an air pump.

British Army Telegraph.

For this service there is at present one troop of the Royal Engineer train which is divided into three sections, each carrying twelve miles of wire, in half mile lengths. These pieces can be conveniently joined by an ebonite jointer which makes a practically watertight joint in less than half a minute, and which in the case of searching for faults, can be undone in even a less time. The cable consists of a strand of seven No. 22 B. W. G. copper wires, insulated by Hooper's compound and made three inches thick; it weighs 300 pounds per mile. For service it is carried on wooden drums, which again are placed on the "wire wagons," and are to be drawn by six horses. The wagons consist of an under carriage and wheels of an ordinary service wagon, the whole made as light as possible of "Clarkson's material." Upon this carriage are ranged six drums in two rows, so placed on framework that the wire may be paid out as required from the rear drum as the wagon advances. Thus on each wire wagon is carried three miles of wire and two dozen iron poles intended to lift the wire overhead when passing cross roads; for, although the insulation is so strong and good that it has stood and will successfully stand a great deal of ill treatment, such as carts and carriages passing over it when laid unprotected on a hard macadamized road, yet it is not to be expected that anything less durable than a rod of iron could stand the traffic of an army. The poles are formed of wrought iron tubing in two lengths, the butt ten feet long and one and a quarter inches in diameter, the top nine feet long and one inch in diameter fitting inside the butt and fastened, when in use, by a bayo' net catch. These poles can be stayed, if necessary, by three guys provided for the purpose. The wire is held in a wooden plug which fits into the top of the pole.

There is also carried, by each wire wagon, a hand barrow which is fitted with legs, and, as occasion demands, with wheels, so that it is capable of taking a drum of cable when the wire wagon may either not be able or not required to go. There are, moreover, two wrought iron earth plates eighteen inches long, four and a half inches wide, and some one half inch thick, which are strong enough to be driven home in any possible soil, and a six gallon cask of water to insure some moist earth. This, with a jointed ladder of two nine feet lengths, and some spikes to lift the wire on to a wall if want-

ed, comprises the main part of the furniture. There is a very neat arrangement on the hind wheel, by means of which the wire when laid out can be rolled up by the action of that wheel. Finally, there is a little hooked stick for lifting the wire as delivered on to the hedges or fences which ordinarily bound the road. The office wagon, not unlike a travelling photographer's van, contains a pair of Morse recording instruments fitted with Siemens' polarized relay, and with Digny's felt ink roller, which has been deliberately preferred, to the possibly more scientific arrangement of Messrs. Siemens, as being more portable. The pattern of battery at present in use is a form of Daniell's, arranged for portability by Sergeant Mathison, R. E., of the Electrical School at Chatham. This school is intended to facilitate the training of men from the ranks to the duties of telegraphers.

Thermometrical Experiments.

The Providence *Journal* describes the following interesting experiments made in that city with an excellent glass mounted thermometer.

In the house with open windows, it stood at 90·2°. Out of doors in the shade, at 95°; freely suspended in the sun, six feet above the greensward, 99·5°. In the same position, with wet bulb, 79·9°; with bulb covered with black silk, 169·96°. When laid upon the grass in the sun, it rose to 104°. Laid upon white cloth, placed upon the grass, 105·0°, and when similarly placed upon black silk, it indicated 113°.

The experiments with different colored coverings show very conclusively the utility of light colored clothing for those who are obliged to be exposed to the direct range of the sun at high temperatures; and the experiment with the wet bulb shows as clearly the value of free perspiration in keeping down the temperature of the body, which, however, the observer finds in his own person, notwithstanding the perspiration while making these experiments, to have risen to 100·5°, which is about two degrees above the usual standard for cooler days. The average temperature of the healthy human body throughout the year, in temperate climates, is 98·4°; while in tropical regions it is about one degree higher

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DURING a recent fire at Ithaca, N. Y., one of the steamers was stationed on the high bridge over Fall Creek, just below the foot of the main fall. When the fire was nearly out, the bridge, without any warning by cracking, fell, carrying with it the engine and the people who had congregated there to the number of about 200. The bridge was 20 feet above the water, and the whole of it went down together. Fifteen persons were seriously injured.

SEVERAL citizens of Sacramento, Cal., having been poisoned by the use of what is there known as the "sanitary composite" water pipe, the Board of Health have ordered its use to be discontinued. Water flowing through this pipe was found, on chemical analysis, to contain lead and arsenic. The pipe in question is believed to be composed of a species of brass.

ALLOYS FOR BELLS, GONGS, CYMBALS, ETC.

The alloy for bells, known under the name of "bell metal," is generally composed of copper 78, and tin, 22 parts; total, 100 parts. This alloy is a yellowish white color, hard, brittle, difficult to file, and with a crystallization without luster. It acquires a certain malleability when it is rapidly cooled off, whether by immediate exposure of the casting to the air, or by being dipped in water. From analysis of old bells, made by modern chemists, it has been found that the proportion of tin varied from 20 to 26 parts to 100 of copper. These bells were rarely manufactured with new or pure metals; therefore, the analyses have often shown the presence of foreign compounds useless or detrimental to their qualities, especially certain white metals, such as zinc and lead. The former metal when in small proportion, may not really prove a defect in bell metal. It has even been tried purposely in certain alloys. Indeed, although zinc neither improves the quality nor the sonorousness of the alloy, it does not act very badly, and allows of the manufacture of cheaper bells, which, however, are not so perfect as those made of copper and tin alone. It is not so with lead, which, if present—even in a very small proportion—in bell metal, will impair its sonorousness and hardness: therefore lead must be avoided at all events. We do not see any serious objection to the introduction of zinc into the bell metal, provided too much of it be not added. A small proportion of zinc renders the alloy more homogeneous, dense, fluid, and ready to acquire the tint of old bronze. It also gives a more economical metal, which explains the sensible reduction in the price of bells at present manufactured on a large scale in certain works. These manufacturers will soon crush the strolling melters, who for centuries had the monopoly of the casting of bells.

The new manufacturer of bells tries to work rationally; he analyses and experiments with various compositions, in order to apply the metals to the best advantage. In the past, on the contrary, there were no other rules than that of the thumb, and old metals were employed, such as broken kitchen utensils, spigots, tinned copper, with solder, etc., which could give but dubious results. If we add to that the want of precise data as to the proportions, the alteration by fusion of the alloys of copper and tin, etc., we must not wonder at the differences shown by the analyses of various bells. These variations were ascertained, especially during the crisis of the French revolution, when the church bells were taken for the manufacture of cannon and coins. Besides copper and tin, the presence of zinc and iron was often detected, and also, but not often, that of silver and gold. The presence of the latter was less frequent than is generally supposed. If some credulous minds at certain epochs have brought precious objects of gold and silver to be added to the bell metal, in order to gain indulgences or to make a pious offering, we must believe that the founders were smart enough to pass the valuable offerings through a less ardent fire than that of their furnaces; as, witness the celebrated bell of the belfry of Rouen, known under the name of the "silver bell," and which was believed by tradition to contain an enormous amount of silver. Its analyses, however, made by the learned chemists of the Paris mint, gave: Copper, 71; tin, 26; zinc, 1·8; and iron, 1·2; total 100 0; and not a trace of silver! As we have already said, it is difficult to preserve the ultimate proportions of bell metal; this is also true of alloys. It is therefore necessary to increase the proportion of tin if we desire that the alloy should have the composition demanded. But whatever be the excess of tin added, we can never arrive at a perfectly exact composition on account of the oxidation during the fusion, variable with the fire and shape of the furnace, and of the phenomenon of separation which takes place in the mold, if the metal has not been well stirred and properly cast.

From experiments on samples of bell metal made at different times, we have ascertained variations in the alloy from 18 to 35 parts of tin for 100 of copper, In order to counterbalance the loss of tin in the alloy, we believe that without increasing the proportion of tin, a bell metal might be composed of copper, 79; tin, 23 ; zinc, 6: total 108 parts. If we suppose that the fire is properly managed, and that no unforeseen accidents take place during the melting and the casting, the cast bells ought to have a ultimate composition of copper, 78; tin, 20; zinc, 2; total, 100 parts, which corresponds to a hard, tough, and slightly malleable metal, the sonorousness of which has not been sensibly changed by the presence of zinc. The quality of bells, in regard to sound, resistance, etc., also depends upon the shape and particular processes of molding and casting, outside the question of the alloy.

Zinc, and even lead, are employed in England for the casting of bells; but if the latter metal is tolerated at all, the the proportion must be exceedingly small, just enough to perfect the homogeneousness of the alloy.

Several analyses of modern English bells give, on an average, copper, 80; tin, 11; zinc, 6; and lead, 3; total 100. In old bells of the same country, an exaggeration of tin has been found, as much as 40 per cent of the alloy. These bells were exceedingly thick, and their shape was widely different from the forms recognized by our present founders.

In France also, the proportion of the white metals, such as tin and zinc, is exaggerated, especially in the alloys for hand bells, clock bells, etc. For such objects, the common alloy employed is a sort of *potin* (yellow pewter) made of copper, 55 to 60; tin, 30 to 40; zinc, 10 to 15; while the metal for gongs and cymbals is composed, on an average of copper, 75; and tin, 25; total 100. This metal is whiter, more sonorous, more brittle than bell metal, and is not so easily filed. Chinese gongs, analyzed by Mr. Darcet in 1832, have shown 78 parts of copper to 22 of tin, and a specific gravity — 8·815.

The composition for cymbals, admitted in the shops of the school of Châlons, after the experiments by Mr. Darcet, was copper, 80·5; and tin, 18·5; total 100·0. These alloys are brittle and cannot acquire the desired resistance and sonorousness, unless they are dipped into cold water after being heated up to a certain point. The alloys of copper and tin possess the property which we have already mentioned of becoming very malleable after having been brought up to a red heat and immersed in cold water. This property is made use of in the manufacture of gongs and cymbals.

These instruments, cast in a slightly loose and green sand, in order to avoid any fracture by shrinkage, are then brought up to a red heat, and dipped into water with certain precautions. After this operation they may be forged and hammered. The proper pitch is imparted to them, either by the tempering process, or by a more or less protracted hammering at certain places, or by annealing them after they have been hardened by the hammer.—*Ironmonger.*

Our Need for Artesian Wells.

Midway between the Mississippi and the Pacific lies an elevated plateau of land, over three thousand feet above the level of the sea, uninhabited and uninhabitable—the American Sahara,—six times larger in area than the six New England States. The soil is rich in every element that combines to produce vegetation; the atmosphere is pure and healthy; nothing is needed but water. For twelve hundred miles the traveller follows the westward course of the sun without the sight of grass or tree, except where some stream gives life and greenness to its narrow margin: he sees nothing in all his course but the dry, gray, sage brush, contemptuously known to miners as grease wood. This great plain is above dew point; rain is a comparative stranger; and the streams that start through the mountains, after a short fight for life, sink away into the sands of the desert. To tap these springs, uselessly sparkling in their underground darkness, it is only necessary to bore a hole not far from five hundred feet deep, and at an average expense of about five thousand dollars; and in return for this trifling outlay, the surrounding territory will be converted into the home of man.

When water can be obtained, no part of our country is more productive. Polygamous Utah presents a city whose streets gladden the eye with foliage and the ear with the ripple of water; and the population about the city raise enough for its consumption and for large sales to traveler and to outsider. The young colony of Greeley grows apace on the strength of its water, brought from afar. Whenever this can be secured, agriculture follows. To obtain this element, one man proposes to dam up the Colorado, and scatter its waters over the plain; others offer to catch the snow cold streams as they leave the base of the mountains, and distribute them among the neighboring farms. But these sources of supply would be literally but drops in the desert, compared with the great extent of waterless territory, and would be entirely local in the amount they would furnish. There is but one certain source of supply for irrigation or consumption, and that is by artesian wells.

The oldest artesian well in Europe is at Lillers, in the *Pas de Calais*, and from its mouth water has flowed uninterruptedly for seven hundred and forty-six years.

Most valuable of artesian wells—valuable not so much for its large amount of water as for its contribution to science—is that of Grenelle, in Paris. It was sunk eighteen hundred and two feet below the surface of Paris, or sixteen hundred and ninety-eight feet below the level of the sea, before it reached water. Such is the force of hydrostatic pressure, that the water is not only impelled eighteen hundred feet to the surface of the earth, but gushes upward one hundred and twenty two feet farther, supplying more than half a millien of gallons a day of pure, soft water for municipal use. It has fully repaid its cost in its benefit to Paris; it has also benefitted the world and Science by proving the correctness of geological theories. The student foretells to us the inner structure of the earth before the first blow of the pick is struck, and makes known a certainty of water where the only surface signs are sterility and barrenness.

The deepest artesian well in this country, and one of the deepest in the world, sunk by the Messrs. Belcher for their sugar works near St. Louis, brings to light nearly five thousand gallons an hour; but its warm temperature of 73° Fahrenheit and its saline qualities render it unfit for most purposes.

Japanese Carved Work.

It is a somewhat remarkable fact that, in all the varieties of ornamentation applied to such materials as porcelain, textile fabrics, paper, and in pictorial illustrations generally, the Japanese never resort to shadows for the purpose of giving the effect of relief. It is a remarkable fact because, as a race, their artists are passionately fond of relief in everything, and adopt it everywhere it can be properly used. They acknowledge the great law in decorative art that flat surfaces should not appear to be relieved, but be treated as flat surfaces; and they adopt relief only where it can be properly used. When relief is wanted, the Japanese artist has countless expedients for securing it; in porcelain, he molds it from the clay, or applies it by lac; in metal work he casts it, sculps it, or beats it up; in ivory and wood, he carves it; in lacquer work, he brings it up by coat after coat of varnish; and in embroidery, he plies thread over thread with patient care until the relief is gained. Of all the carved work of the Japanese, the most wonderful and interesting are their ivories, called *netzkes*. These consist of groups of figures and animals, grotesque figures and representations, in short, of nearly every natural object in Japan, most truthfully rendered. It is quite impossible to give any idea in words of the quaint humor, the broad caricature, the intense power of expression, and the general artistic excellence which stamps every *netzke* in which the human form appears with an individuality distinct from all kinds of a kindred nature produced in other lands. A firstrate Japanese *netzke* has positively no rival. The carving of these ivories is carried to the highest degree of perfection, and its effect is frequently enhanced by the partial application of color and gilding. The Japanese are likewise skillful in wood carving, and they frequently substitute it for ivory in their small works.

Ocean Waves.

Wilkes, in 1839, made a careful measurement of waves on one occasion when the sea appeared regular and the waves of a great height. This was his method: The schooner *Seagull* was sailing in the wake of the brig *Porpoise*, and distant from her by about two waves. Their relative positions did not seem to vary, and they were sailing eight knots an hour. Casting the log from the *Porpoise*, Wilkes observed that the clip, when on the top of the nearest wave, was 380ft. distant, or one sixteenth of a mile, and the *Seagull* on the top of the next wave, twice as far, or one eighth of a mile. The time taken by a wave to come from the *Seagull* to the *Porpoise* was, on an average, thirteen seconds. This gives 26½ miles per hour for their apparent progressive motion. For observing the hight, Wilkes chose a moment when the *Seagull* was in a hollow, and the two crests were in a horizontal line with his eye, this line cutting the *Seagull's* mast at a certain hight. His observation gave 32ft. as the wave hight. Various observations have been made of wave hight. The captain and officers of the *Inconstant* on one occasion saw waves that, as they showed, must have been more than 77ft., and waves have been known to reach the top of Eddystone lighthouse, 106ft. In estimating the motion of waves, it is to be remembered that the atmosphere exercises the pressure of an elastic force of about 2,000lb. on each foot of the wave surface, and this must be added to the weight of water forming the wave. From a series of experiments made by Mr. Walker, at Plymouth, the following inferences are made:—1, The speed of waves is retarded in proportion as the water becomes shallow, and depth facilitates wave action. 2. The speed of waves does not depend on their hight. 3. The experiments made on a large scale seemed to confirm the result obtained by Mr. Scott Russell in another way—namely, that when the depth of the water becomes equal to the hight of the wave, the latter breaks and becomes a wave of translation.

Among the waves observed were some moving 46ft. per second; these were wide apart and of short hight. Their destructive effect on masonry was, nevertheless, very great, while certain other waves, which were higher and in closer succession, and moved 41·8ft. per second, were much less destructive. The effect being as the square of the velocity, we may calculate what should be the hight of waves which, moving at the rate of 41·8ft. per second, would have an equal effect with waves 27ft. in hight, and moving 46ft. per second (27ft. having been the hight of those observed to move 41·8ft. per second). Thus $41·8^2 \times 27 = 46^2 \times x$, whence $x = 22$.

The hight of waves in the Mediterranean has been estimated by W. Smith as in general from 14ft. to 18ft.

Notes About Rats.

A gentleman, who has passed many years of his life at St. Helena, told me lately several stories about rats, so curious that I thought them worthy of record. He said that at one time the common brown rat was extremely common all over the island, in fact, a perfect pest; and to avoid its attacks his father had constructed a large store, rat proof: namely, a rat once in could not get out again. A number, however, came in with produce and goods from the ships, and bred there. Around this store were venetian blinds to the windows, and one day one of his men, when it was raining, watched a rat sitting on the venetian and putting out his tail to collect on it the drippings of water at the edge: he then withdrew it and licked it. The servant told his master, who immediately understood that the rats could get no water inside the store, and therefore directed that a butter firkin should be cut down to four or five inches, and in the top a large circular wire rat cage trap should be fixed. Several small planks were placed for the rats to get up to the entrance to the cage, which exactly fitted the firkin. No food would have induced the rats to enter the trap, but water did, and many were thus captured. There is one peculiarity with these rats, namely, their very often building or making their nests in the trees. I have in India several times found rats' nests in trees; but they have always been stolen nests, such as deserted abodes of the squirrel or sparrow; but here my friend, who is no naturalist, tells me that they construct them principally of fir spines, on the ends of the boughs some twelve or fifteen feet from the ground, in the common fir trees. The spots selected are just where the overlapping bough nearly meets the lower one. He said that all know the rats' nests, and that he had seen them fired at, when many rats were killed and fell out to the ground. He could tell me no more, and I think that, if original nests, as he held them to be, some grass must be woven in their construction, as fir spines have but little power of cohesion. The situation of these nests was worthy of notice, although there is scarcely a situation where a rat's nest has not been found.—*Science Gossip.*

THE conversion of water into vapor develops electricity

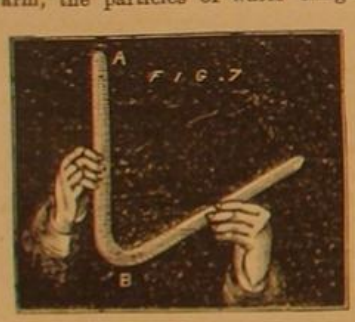
HEAT AND LIGHT.

Report of a recent lecture by Professor John Tyndall, before the Royal Institution.]

Liquids expand in general more than solids. I may here remark that the ordinary definition of the solid, liquid, and gaseous states, given in many text books, is hardly correct. Cohesion is thought to be predominant in the first state of matter, absent in the second, and negative –that is to say, that absolute repulsion exists among the molecules—in the third. But liquids may be strongly cohesive; and, indeed, the researches of many physicists have shown that there is not an absence of cohesion among, but sliding powers possessed by, the molecules of matter in the liquid state. If air is expelled from water, it is still liquid, but the cohesion of its molecules becomes very great.

To M. Donny, of Ghent, we are indebted for the discovery of an interesting property of water, illustrative of the cohesive force it possesses. On heating water, air bubbles crowd to its side long before it boils, rising through the liquid without condensation. The air thus liberated has been held in solution by the water, and one of the remarkable effects it produces is that it promotes ebullition. It acts as a kind of elastic spring, pushing the atoms of water apart, and thus helping them to take the gaseous form.

The tube I hold in my hand, which, after the inventor, is called Donny's tube (Fig. 7), contains water which has been freed from air by boiling. My friend, Mr. Justice Grove, would say it is impossible entirely to free water from air by boiling, but this water has been very nearly freed. Having lost the cushion which separated them, the cohesion of the atoms of water is vastly augmented. One effect, as you hear, is that the water, running from end to end of the tube, strikes against it with as rude a shock as if it was a solid body. You hear the sharp metallic ring it sends forth when I turn it upside down. I bring the water into one arm of the V by tilting the tube; you see it flows freely from one arm into the other. I now tap the end of the arm containing the water on the table. At first there is a slight jingling noise; as long as you hear that sound, the water is not in true contact with the tube; I continue tapping, the jingling soon ceases, and the sound is now perfectly hard—like that of one solid against another; the interstitial air, which it is impossible wholly to exclude from the tube, has been removed, and if I now raise the tube. the water remains in (A B) the arm, the particles of water clinging so tenaciously to the



sides of the tube that it refuses to behave like a liquid body; it declines to obey the law of gravitation.

But Donny pushed his researches further, and found that the boiling point of water was very greatly elevated when the water was free from interstitial air; indeed, that it could be subjected to a temperature 50° Fah. above its ordinary boiling point before ebullition took place, and that then, instead of boiling in the ordinary way, molecule by molecule, as it were, that the whole or nearly all the water is converted into vapor at the same time with a sudden crack like an explosion.

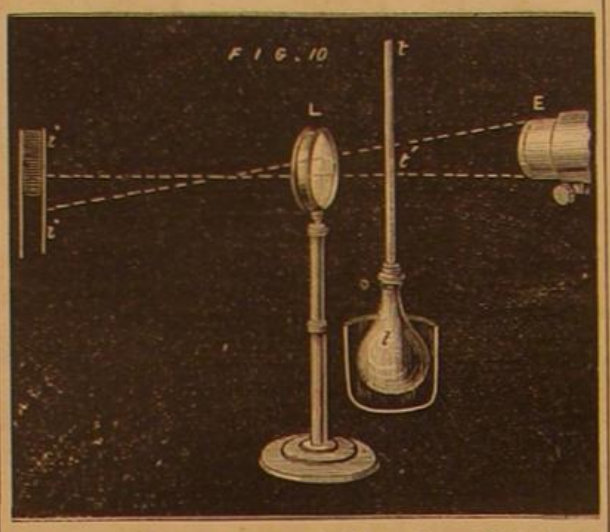
Faraday took great interest in this experiment, but in his mind it was like the ignition of a match, which instantly produces more light. His mind may be said to have possessed the potential power of a muscle, while a new fact acted like the nerve of that muscle; possessing no force in itself, it

nevertheless acts as a trigger, unlocking a new force. In such a way did this fact act in the potential power of his mind.

He had known and wondered at the extraordinary power possessed by bodies, in crystallizing, of excluding air; and that water in freezing, that is, in taking a crystalline form, excludes everything extraneous to itself. Could he then get pure ice melted without contact with air, he would have water still more perfect than Donny's boiled water, and it ought to produce the same effect. Well, he surrounded his ice with oil—melted it—the oil floated on the surface of the water, and he found that the water could be heated 60° Fah. above the ordinary boiling point, and that when it did boil, it boiled with a sudden explosion.

This experiment was performed: A small lump of ice was placed in a clean test tube in an oil bath, and just covered with oil (Fig. 8), the whole being surmounted by a glass jar to avoid scattering the oil. When the water boiled, it did so with a sharp explosion, violently discharging the oil above it into the jar. A second tube, containing common water covered with oil, boiled tranquilly.

We will now send a beam of heat through a plate of ice, and take down the crystalline structure of the ice. It will pull the crystals to pieces by accurately reversing the order of its architecture; silently and symmetrically the crystallizing force built the atoms up, and silently and symmetrically the electric beam will take them down, producing the beautiful flowers with six petals, with which many of you are familiar (Fig. 9).



When these flowers are examined by reflected light, in the center of each flower appears a spot which shines with a silvery luster; these spots are not air bubbles, but a vacuum, the water occupying less space than the ice previously did. Imagine the flower forming and gradually increasing in size. The cohesion of the liquid is so great that it will pull the walls of its chamber together, or even expand its own volume sooner than give way. But as its size augments, the space which it tries to occupy becomes too large for it, until finally the liquid snaps with an audible clink, and a vacuum is formed. When I first heard this noise, I suspected my imagination to be in fault, but I soon found it to be a reality, and that when water is thus split, one can hear the rend.

Let us now return to our expansions. Most liquids expand by heat and contract by cold. Alcohol is a good example; its expansion continues till it reaches the boiling point, and it contracts again at one even rate to the lowest temperature. It has never been solidified.

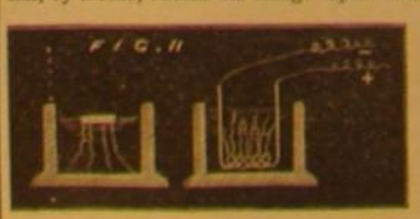
A far more interesting case of expansion is that of water, inasmuch as it exhibits a wonderful exception to the usual law of contraction by cold. If heat be abstracted from water, it goes on contracting till it reaches a temperature of 39° Fah., or thereabouts, at which point contraction ceases. This is the so-called point of maximum density of water; and from this point downwards, till the freezing point is reached, the liquid instead of contracting expands, and when it is converted into ice the expansion is considerable.

The flask filled with water, A, is tightly corked (Fig. 10); through the cork a tube, *t*, passes watertight, and the liquid rises within it. A strong beam from the electric lamp, E, passes across the tube, and by means of the lens, I, an enlarged image of the liquid column appears on the screen, *i i*. Of course the image is an inverted one, and when the liquid expands, the top of the column will descend the screen. Heating the flask by a spirit lamp, at the first instant the head of the column ascends as if the liquid contracted. This is due to the momentary expansion of the flask to which the heat is first communicated. Now it stops and commences descending the screen, and does so until the liquid reaches the top of the tube, a single drop running over.

I now cool the flask by plunging it into the freezing mixture of pounded ice and salt. You see the column gradually sinking, now a point is reached at which the contraction becomes very slow, and at last it stops altogether; and now expansion begins; putting in a little more of the freezing mixture, it rapidly increases—for the colder the mixture, the quicker the expansion—and you see it goes on till the water is actually thrust out at the top of the tube by the cold, exactly as it had been by the heat.

The force of this expansion is very great. Mr. Cottrell will place a bombshell and an iron bottle in a freezing mixture, covering them both. Before we follow the result to its consequences, we will show the manner in which heat diffuses itself through liquids.

I have here a glass cell (Fig. 11) into which I plunge this platinum spiral, *a*, which I can heat by means of a small battery, throwing upon it a beam from the electric lamp; I can, by a lens, obtain its image upon this screen, and now



making contact, the wire is heated, and heats the water surrounding it, which, as you see, rises to the surface. Taking another cell (Fig. 11) and allowing a fragment of ice to float upon the water, the difference of refraction between the cold and the warmer water enables you to see the descending current. In the one case the water streams upwards, in the other it streams fast downwards. Thus, in a general way, it is illustrated that the lighter water rises and the heavier water sinks.

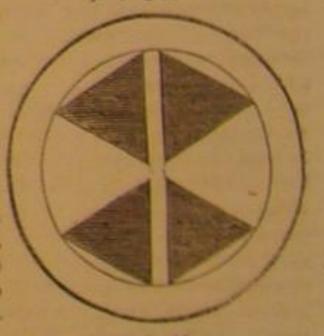
In order fully to appreciate the value, of the infraction of the general law of contraction by cooling, we may examine the case of a lake exposed to an atmosphere below the freezing point. The surface is chilled, the water contracts, becomes heavier and descends, its place being filled by the lighter water from below. This, in its turn, is chilled likewise and sinks. Thus a circulation is established, the cold dense water descending, and the lighter warmer water ascending to the top. Supposing this continued, the whole of the water of the lake would ultimately become one solid block. But just as matters become critical at the temperature of 39° Fah., the water expands by cooling, and swims like a scum on the top of the warmer water beneath. Solidification ensues, and the ice, being much lighter than the liquid, forms a protecting roof over the living things below.

When this fact was first made known, I believe by De Luc, afterwards by Blagden and Hope, it produced a strong impression. Rumford says: "Though it is one of the most general laws of Nature with which we are acquainted that all bodies, solids as well as fluids, are condensed by cold, yet, in regard to water, there appears to be a very remarkable exception to this law. . . . All bodies are condensed by cold without limitation, water only excepted. . . . This exception to one of the most general laws of Nature, a striking proof of contrivance in the arrangement of the Universe, a proof which comes home to the feelings of every ingenuous and grateful mind . . . for though the extensiveness and immutability of the general laws of Nature impress our minds with awe and reverence for the Creator of the Universe, yet exceptions to those laws, or particular modifications of them, from which we are able to trace effects evidently salutary or advantageous to ourselves and our fellow creatures, afford still more striking proofs of contrivance, and ought certainly to awaken in us the most lively sentiments of admiration, love, and gratitude;" and further on, he adds: "I feel the danger to which a mortal exposes himself who has the temerity to undertake to explain the designs of Infinite Wisdom. The enterprise is adventurous, but it cannot surely be improper." I think it is adventurous to attempt to get at the designs of Infinite Wisdom. The case of water is not exceptional. The metal bismuth expands at the time of crystallization by cooling from the molten stand. A bowl of molten bismuth becomes covered with a crust, which is broken through in little craters, as the cooling progresses.

How are we to figure this act of expansion? It is manifestly preparatory to the act of crystallization. The idea of polar force, which we are accustomed to from the study of magnetic phenomena, has been applied to crystals. They build themselves into definite shapes, hence they must arrange themselves in a definite manner, and the forces which produce this definite arrangement are now called polar forces

Now to revert to water. Each molecule of water contains three atoms (Fig. 12); thus the sphericity is destroyed, and we have pyramidal little masses for the molecules. Let us next take a section of a pyramid, a triangle. Suppose triangular molecules to approach each other by a mutual attraction of the general mass; the forces issuing from the poles would be for a time insensible. At last they come within each other's play, and produce immediately a re-arrangement of the molecules with respect to their axes.

FIG. 13



This model will in a rough way demonstrate the point (Fig. 13). The bases of the triangles are facing each other, as they are drawn together, the center of gravity of each being one third of the length of the line bisecting the base, drawn to the opposite angle; when they are brought thus close, we may imagine that the polar force is brought into play as against the gravitating force, and that the vertices are drawn face to face (Fig. 14). The center of gravity is two thirds from each vertex, and as you see by their encroachment on the outer circle, expansion is the result. The triangles now take up more room than they did before.

FIG. 14

[The burst bomb and iron bottle were now shown, and reference made to the influence of pressure upon the freezing point.] To solidify, water must expand. But if the vessel be rigid it cannot do so, hence, in a rigid vessel, it would remain longer liquid. For every additional atmosphere of pressure, the freezing point is lowered 1-75th of a degree Fah., and it is raised 1-75th of a degree when atmospheric pressure is removed.—*Mechanics' Magazine.*

A STATUE of Shakespeare has just been erected in Central Park, New York. The sculptor was J. Q. A. Ward. As a work of art, it is considered a great success. Some say that it is the best Shakespearean sculpture ever made. Crowds of people flock to see it.

Improved Farm Gate.

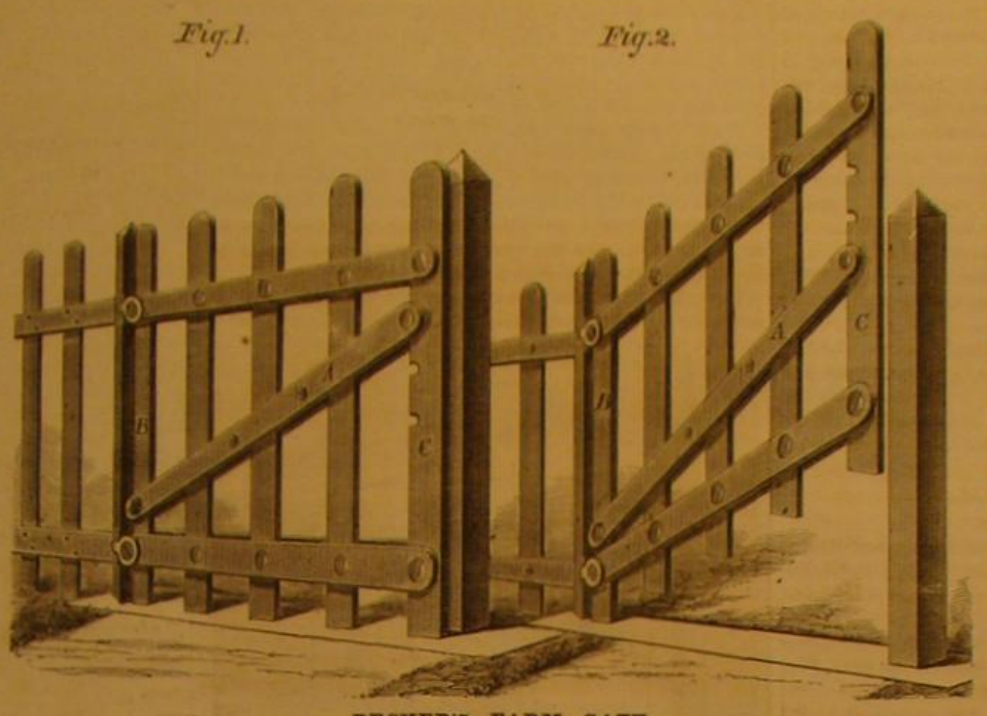
Mr. E. B. Decker, of Carrolton, Greene county, Ill., has made an improvement in gates, which we here illustrate. The invention appears a good one, and is likely to obviate a great many defects in other farm gates.

Fig. 1 is a view of the closed gate. It is constructed of upright slats and horizontal rails which, instead of being firmly connected, are riveted together so as to be able to move freely round the rivets. The position of the gate is maintained by the brace, A, which diagonally crosses it. This brace is composed of two pieces, which are riveted together as shown in the engraving, the rear end being pivoted to the hinge slat, B, and the forward end being supported, by its rivet, in a notch in the front slat, C, and, at the same time, bracing the front slat, so that it cannot fall lower and bring the gate out of position. It is obvious that, if the front slat were raised, it would allow the brace to fall into the next notch, and so on until the gate reached the position shown in Fig. 2, in which the brace would firmly hold it. The brace will thus admit of the gate being raised without being opened, to allow of sheep, cattle, etc., passing under it and to clear the winter snow; while sagging is prevented in any position.

Patent is now pending through the Scientific American Patent Agency.

Further information may be had by addressing the inventor as above.

Fig. 1. *Fig. 2.*



DECKER'S FARM GATE.

IMPROVED PUDDLING TOOL.

The process of hand puddling, in the ordinary reverberatory furnace used for the purpose, can be divided into four stages:

(1) Melting. The pig iron, together with a proportion of hammer slag, is charged on the bed, previously lined with either puddling mine, bulldog, or both, and plastered over with wet hematite ore. As the cast iron gets softened by the heat, it is broken into smaller pieces and stirred up with the cinder. This is done by the hand rabble, which has to be continuously moved over the whole surface of the bed. This stage lasts about thirty-five or forty minutes.

(2) In the second or boiling stage, the iron has to be violently rabbled in order to bring it into a state of ebullition or boiling. In this operation, the puddler has to exert himself very considerably, working the rabble to and fro, and from side to side, over the bed.

(3) "Coming to nature." The iron now begins to thicken and to get tougher and tougher; the "boil" stops, and it "comes to nature" or begins to assume the consistency of heated wrought iron. The puddler works it in this pasty consistency from side to side of the furnace, separating it into different pieces.

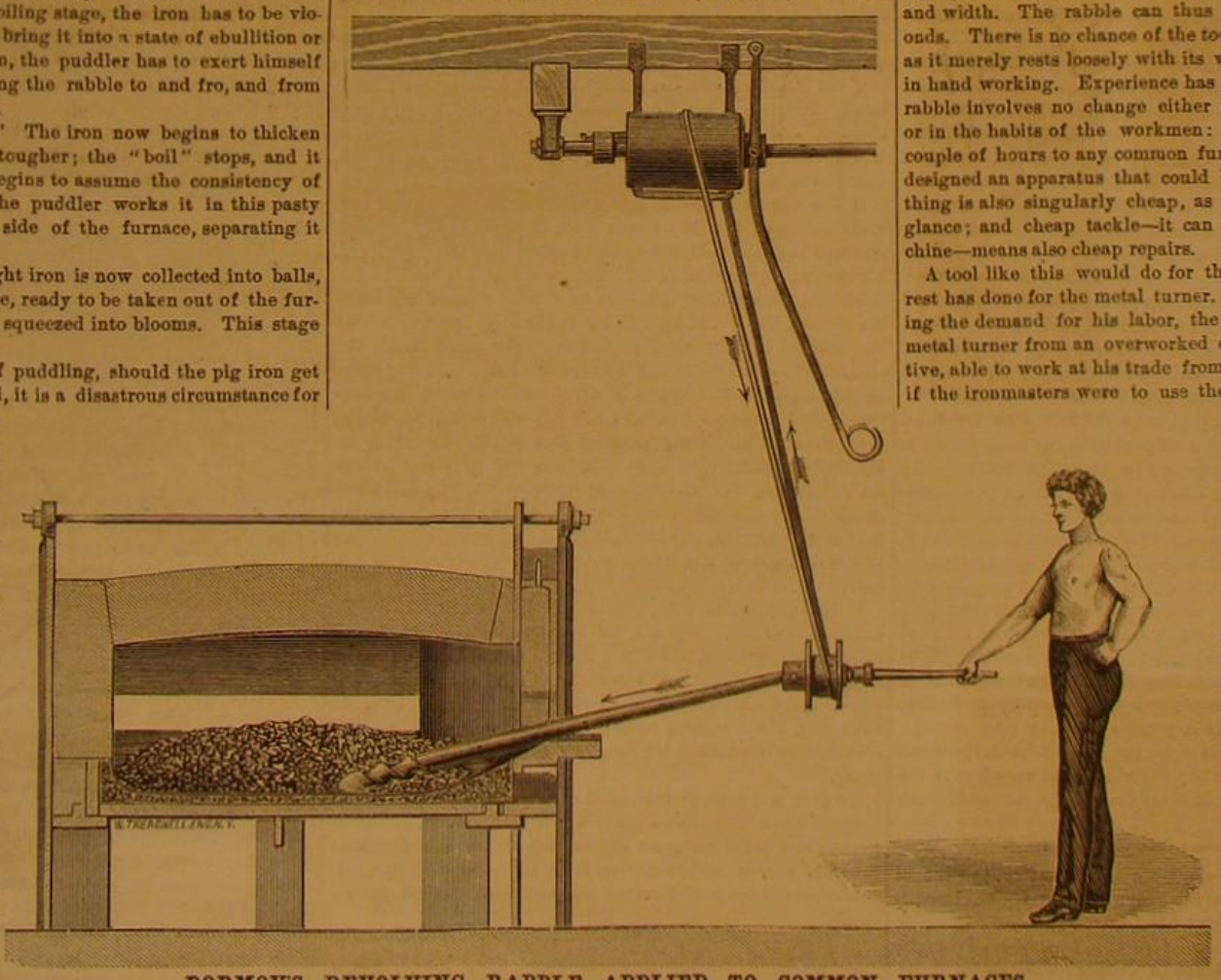
(4) Balling. The wrought iron is now collected into balls, varying in weight and size, ready to be taken out of the furnace to be hammered or squeezed into blooms. This stage takes about ten minutes.

In the ordinary mode of puddling, should the pig iron get entirely melted on the bed, it is a disastrous circumstance for the puddler. The bath of metal, with its even surface hidden under the lighter cinder, offers very slight surfaces of contact to oxidation. To meet this, he is forced to very violently exert himself in stirring up the metal; and he is obliged to shovel in quantities of hammer slag, cinder, or other sources of oxygen, which cool down the metal and lower the quality of the product.

There can be no doubt that an unaided man's strength is insufficient for this labor. Dr. Percy, whose opinion as a metallurgist, chemist, and medical man is universally known to be of the very highest importance, states that the majority of puddlers "die between the ages of forty-five and fifty years; and, according to the returns of medical men to the registrar, pneumonia, or inflammation of the lungs, is the most frequent cause of their death. This is what might have been anticipated from the fact of their exposure to great alternations of temperature under the condition of physical exhaustion." They are also liable to cataract, induced by the intensely bright light of the furnace; and the forearms and faces of some puddlers are also often scorched to a bright red tinge in a curious way. As Dr. Percy observes, "it is not surprising that puddlers should manifest a growing disinclination to bring up their children to his occupation, to which, as a general rule, their strength ceases to be equal beyond the age of forty-five or fifty." On the puddler more than Adam's curse seems to have fallen—copious drops transpire, not merely from his brow, but from all his almost naked body, while engaged in what Mr. W. Bridges Adams has termed "the absurdity of setting a number of human beings to stir up a metallic pudding in order to throw off the scum."

To Mr. Edward Hutchinson, of Messrs. Pease, Hutchinson & Co., Skerne Ironworks, Darlington, England, belongs the merit of having first invented and experimented with the revolving rabble. His trials were very successfully carried out as long ago as 1865, being, however, relinquished during the same year, and without having been published in any way. M. Dormoy quite independently took up the same idea, and has been perseveringly working it out since 1866.

Any puddling machinery must be essentially simple and non-liable to get out of order by the roughest and most careless usage. This simplicity, required by the men, is also required by the furnace; the high temperature of which, with the attendant rapid current of air passing through, must not be interfered with.



DORMOY'S REVOLVING RABBLE APPLIED TO COMMON FURNACES.

A glance at the accompanying illustration will render the whole apparatus intelligible. A common belt, driven from shafting six feet above the furnace, rotates the sheave, loosely jointed at one end to the puddling rabble, and at the other turning on a pin held in the hand of a puddler.* To prevent any jarring action to his hand, the pin he holds may be wound round with spun yarn or gasket, embraced by a leathern or india rubber tube. The strap thus rotates the rabble, supports part of its weight like a suspension link, and acts as a universal joint, much as in the familiar instance of the rotating hair brush. The belt must evidently adapt itself with ease to the great variety of positions which have to be taken by the tool in every part of the furnace, to the necessity for removal when too hot, and to the progressive changes in the metal.

Mechanism could easily be applied to the rotating rabble in order to work it regularly to and fro; but this additional complication has not been found necessary. Its great speed, from 300 to 800 revolutions per minute for white pig, and from 800 to 1,000 for gray metal—is found to give it all the mechanical energy required. The end of one form of rabble, about 4½ inches in diameter, when revolving with 500 revolutions, necessarily has a speed at its circumference of nearly 600 feet per minute. On the other hand, the iron, even when boiling, is not thrown up. The centrifugal impulses are not sufficient to overcome the cohesion of the hot metal. The power required has been indicated by Herr Biedermann, now of Floridsdorf, near Vienna, at from one quarter to one half of a horse power per furnace per hour; but the draft would necessarily increase towards the end of the heat. There is no bearing near the furnace necessarily liable to get hot; no gearing to break on any sudden resistance; and the strap itself acts in its usual way as an admirable friction brake. It is difficult to imagine how the apparatus can come to grief in any other way besides breaking the strap. For such a case, a spare belt is kept hanging on the shaft; or the puddler could even merely go on in the ordinary way. If kept well greased, however, the belt lasts from three to four months without renewal. Any diminution in speed can be obtained by slightly relieving its weight off the belt—thus allowing more or less slip. On the other hand, any unusual resistance can be overcome by the puddler pressing the tool down on the belt. Simply by crossing the strap, the rabble can be rotated from left to right, or *vice versâ*, alternately, as required. The tools, in spite of their extra weight, are easily removed from the furnace by taking them off the strap, by means of a hook on a light chain suspended near the furnace from the roof, and laying them on small trestles about eighteen inches in hight and width. The rabble can thus be changed in thirty seconds. There is no chance of the tool disturbing the fettling, as it merely rests loosely with its weight on the bed, just as in hand working. Experience has shown that the revolving rabble involves no change either in the plant of the works or in the habits of the workmen: it could be adapted in a couple of hours to any common furnace: and the author has designed an apparatus that could be at once applied. The thing is also singularly cheap, as can be seen at the first glance; and cheap tackle—it can scarcely be called a machine—means also cheap repairs.

A tool like this would do for the puddler what the slide rest has done for the metal turner. While actually increasing the demand for his labor, the slide rest has raised the metal turner from an overworked drudge to a skilled operative, able to work at his trade from youth to old age. Even if the ironmasters were to use the revolving rabble merely to relieve their men, and without requiring a greater number of heats from them, they would gain:—(1) A great improvement in the quality of the iron produced; (2) a great diminution in the number of ruinous "cobbles" or "wasters;" (3) the capability of working up very gray or also inferior kinds of pig, without using any "fined metal;" (4) diminution of loss in mill scale between the rolls.

Perhaps the most important truth which has been lately elicited touching mechanical puddling is its effect in improving the quality of the puddled bar. Mr. Danks has worked up almost every kind of American and British pig metal with excellent results as to quality. Mr. Adam Spencer has in his revolving furnace produced excellent iron from Middlesbrough metal containing 2 per cent of phosphorus. As already noticed, experience with oscillating rabbles points to more or less improvement in the quality. Mr. Hutchinson, as we have seen, improved the quality of Cleveland iron with his revolving rabble. M. Dormoy has puddled with success some old cannon balls the Turks left behind them at Temesvar, in Hungary, so white and containing such a large quantity of arsenic as to be utterly intractable by the ordinary process; he has also operated at Zeltweg, in Styria, upon pig metal alloyed with copper and sulphur; upon the sulphurous pig metal of the Loire and

that of the Moselle—the latter containing very large percentages of phosphorus. In every case, perfectly tough iron and steel, often rolled into the most difficult special shapes, have been produced. It is clear to the eye of the mechanic that all these otherwise very differing apparatus are alike in one particular, namely, more or less thoroughly stirring up the first broken, then molten, and lastly pasty, metal, together with the fettling on the bed. The infinite variety of chemical conditions formed by the different kinds of pig and fettling, under which these results have been obtained in England, the United States, in France, Styria, Hungary, and Austria, clearly debar us from searching for any recondite chemical cause; and it is evident that, whether this thorough stirring be obtained by exhausting manual labor, or by an imperfect oscillating rabble, or by a revolving bed or a revolving rabble, the mechanical effect must be the same: That is to say, the molten cast iron has to be continuously stirred up in order, in the common furnace, to expose it to the oxygen entering at the door and contained in the fettling; in Mr. Danks' and Mr. Spencer's furnaces to the oxygen in the latter only.

There thus seem to be three principal reasons why mechan'cal puddling, or, in other words, good puddling, produces such good iron. The operation is (1) completely carried out; (2) the puddled bar is really homogeneous; (3) the multiplication of the surfaces of contact intensifies the purifying chemical reactions.

Nevada Silver.

At the recent meeting of the American Institute of Mining Engineers in New York, the President, R. W. Raymond, read an interesting paper on the silver mines of Nevada, from which we take the following:

The Eureka district stands now third in rank of the silver producing camps of Nevada. During most of the year, four and sometimes five furnaces (combinations of the Rachette and Piltz) have been in blast. Late last year, and in the earlier months of the present year, the Eureka Consolidated Mining Company discovered immensely valuable and extensive bodies of ore in the Lawton tunnel. Raby Hill is a spur of the diamond range. The openings of the Eureka Consolidated, as well as those of the Richmond and Tip Top, are on the western and the new ones on the eastern slope. The strike of the ore body is nearly east and west, and its dip about 45 degrees to the northeast. For this reason ore was first discovered on the western slope of the hill, where the vein crops out.

The Lawton tunnel is now in over 600 feet, and passes 120 feet to the north of the Keyes shaft, between it and the windsail shaft. At its end, it is in ore. The Keyes shaft is now 175 feet deep and serves as the main hoisting shaft for the old works. These are the largest extant in broken quartzite.

The approach to the vein matter is distinguished by a yellow color of the first dense, afterwards broken, limestone; next by a stronger impregnation of pulverulent brown and yellow iron ore and stripes of the first; finally, the ore body proper—brown iron ore, with impregnations and bands of carbonate of lead or lead ocher, is reached.

While on the western slope, besides the yellow memetele, large masses of solid carbonate of lead, with so called "black carbonate," which is probably a new mineral, and little galena were found. The ores encountered on the eastern slope in iron stained masses, which are poorer in lead, are principally highly argentiferous galena and "black carbonate" in lumps and nests of often over 100 pounds weight. For this reason, there is now much more base bullion produced than formerly. Seven tuns of ore now produce one tun of lead, while formerly it required ten or twelve tuns. At Richmond, the best and most profitable smelting works in the State are building energetically. All signs point to the enormous industrial increase during the coming year, especially if capitalists should take up the Prospect Hill mines.

The total product of bullion of the Eureka Consolidated, during 1871, was about 3,172 tuns. The average contents in gold and silver for the whole yearly product may be estimated as $250 per tun. Adding $100 per tun for the lead, we have a gross value of $1,110,314·10. The gross value of the total production of gold, silver, and lead, during 1871, by the various companies, including the Eureka Consolidation in Eureka, was $2,035,588·86; the total quantity of bullion shipped was 5,665 tuns, 1,074 pounds.

All the base metal mines in the district have the same character as those previously described, and vary less in the classes of ores occurring in them than in the size of the ore bodies.

WINDOW SASHES.—The most convenient way, to prevent loose window sashes from rattling when the wind blows, is to make four one sided buttons of wood, and screw them to the stopes which are nailed to the face casings of the window, making each button of proper length to press the side of the sash outwards when the end of the button is turned down horizontally. The buttons operate like a cam. By having them of the correct length to crowd the sash outwards, the sash will not only be held, so firmly that it cannot rattle, but the crack which admitted dust and cold air will be closed so tightly that no window strips will be required. The buttons should be placed about half way from the upper to the lower end of each stile of the sashes.

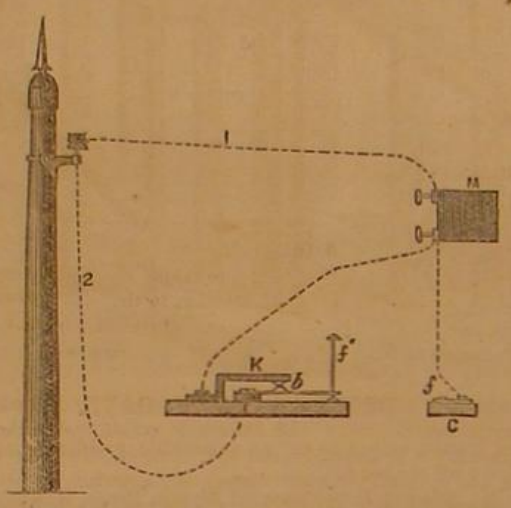
THE *Adriatic*, a new and splendid ocean steamer, recently made the passage from Queenstown to New York in seven days and sixteen hours,—the quickest westerly voyage ever made across the Atlantic.

Testing Telegraph Insulators.

Insulators usually undergo a most careful visual investigation at the factory, and all such insulators as are free from mechanical defects subsequently have to pass through a most delicate system of electrical testing, in order to prove that they are electrically sound, and are really insulators. In spite of all the precautions taken, however, bad insulators do show themselves on land lines. Whether they have escaped the searching tests or have become bad after being put up, such is the case, and a great loss of the electric current is due to the presence of bad insulators on a line—contributing to much bad working.

These defects have made themselves seriously felt on some of the Indian lines, where the insulators adopted are porcelain, protected with a galvanized iron cover; and in order to detect the faulty insulator without the necessity of removing it from a pole, the following plan has been arranged by Mr. Louis Schwendler, of the Indian Telegraph Department, and is presented in *Engineering*:

The principle of the plan is to produce a series of electro-magnetic currents, pass them through the defective insulator, and to measure these currents by the effect they produce upon the body of the person engaged in the testing operation. The annexed diagram will show the arrangement of the wires and the details of the test.



M is a small magneto electric machine connected from one pole by No. 1 wire on to the insulator to be tested, and from the other terminal to the upper part of the small key, K, and also to the platinum stud *f* in C. The lower part of the key is connected to the insulator bolt and bracket; by pressing the metallic key with its platinum stud *f'*, contact is broken between the points at *b*.

It is necessary that the wire No. 1 should be well insulated, so that no leakage beyond that due to the insulator itself can interfere; the No. 2 wire should also be well insulated. Before testing the insulator, it should be properly cleaned, and a temporary disconnection made between it and the line wire; this should of course be done before the connection in the diagram can be made.

If the handle of the magneto machine be turned and currents produced, it will be seen that, if there is any leakage through the insulator, the currents must pass through 1 and 2 wires, and by means of the contact at *b* and K back to the machine; the slightest pressure on *f'* will at once interrupt the circuit, but if the key, *f'*, be pressed by one finger, and the stud, *f*, in C, by another finger of the same hand, the circuit will again be closed through the hand. And if there be any leakage, the slight positive and negative currents due to that leakage (forming a circuit) will be felt as shocks from the machine, in a greater or less degree, according as the leakage is more or less. The amount of these shocks and, of course, the whole management of the test is in the hands of the one experimenter, who, while carefully feeling for the shocks with one hand, is with the other moderating the revolution of the machine to the requirements of the case.

It does not follow that, because no shocks are felt, the insulator is perfect. There is one more test which the experimenter can perform, but which should not be done until the finger test has failed. When such is the case, let one finger remain on *f* and touch *f'* with the tongue; if no shock be then felt, the insulator may be passed as perfect, as the electro-sensitiveness of the tongue may be considered as very great.

To give a practical test of the value of the finger and tongue when applied to such a purpose, Mr. Schwendler made some tests on some insulators (whose resistance had previously been accurately measured) using the currents produced from one of Siemens' magneto alphabetical instruments.

No. of Insulator.	Resistance in Siemens' units.	Force of the magneto-electric currents across the insulators measured by the human body.
1	110	Strong shocks felt by the fingers.
2	130	" "
3	145	" "
4	190	" "
5	253	Slight shocks felt by the fingers.
6	2,800	Shocks no longer felt by the fingers, but strongly by the tongue.
7	5,700	The tongue no longer feels shocks, but a strong acid taste.
8	7,100	Taste of acid distinct, but slight.
9	8,300	" "
10	82,000	The tongue no longer feels any thing.

From the above experiments, it will be seen that, up to 1,000 Siemens' units, shocks may be felt by means of the fingers, and beyond that and up to 8,000 the loss of insulation can be detected with the tongue—an instrument which Mr. Schwendler considers the best for discovering faults of want of insulation, because it is sufficiently sensitive, never gets out of order, and, besides, is the least expensive instrument that one can employ.

Art Progress.

Dr. Dressler lately read a paper, before the Society of Arts, wherein he said:

One of the chief hindrances to the advancement of decorative art is to be found in the designers themselves, many of whom are ignorant and have no art ability; while others who have, often produce works which, though beautiful in form, are inconvenient in use and consequently calculated to bring art into disrepute. The fitness of the ornamentation of an article to the use for which it is designed is the end to which designers must educate themselves.

Certain manufacturers may truly be regarded as hindrances to art progress. It is curious that there are many men who would not rob another of a farthing, and yet who eagerly look for every new pattern which more honorable manufacturers than themselves produce, with the view of copying them if they be good and are not protected by registration, or of producing others as nearly like them as they can if they be registered.

Much has been said respecting the unwillingness of manufacturers to issue designs of an art character, and to pay such prices for patterns as will fairly compensate the designer for producing a carefully considered work. I have had as much to do with manufacturers, I think, as most artists, and I am bound to say that I have found most of them both willing to try new things and to pay handsomely for well considered designs; but the manufacturer cannot be expected to produce many patterns such as will not sell when placed on the manufactured article.

That class of the public who are pleased with whatever is "loud" and showy immediately hinder the progress of art, since some manufacturers will strive for the patronage of the most vulgar taste; but this hindrance will disappear with the increase of art knowledge.

Refrigeration by Means of Ammonia.

A Tellier refrigerating machine, just erected in the largest brewery in New Orleans, owned by George Merz, supplies the large storeroom, holding 5,000 barrels of ale and lager beer, with dry cold air at a temperature of 40°, the temperature outside being 85°. The refrigerating agent is liquefied ammoniacal gas, and to cool this large room but ten cubic feet of the material is required.

A large refrigerating cylinder, through which passes a number of pipes, is filled with the liquefied ammonia which vaporizes, rendering the pipes through which the air passes excessively cold. The ammoniacal vapor is subsequently compressed again into liquid form and returned to the cylinder to repeat the same operation without any waste of the material.

The Carré apparatus, another form of the ammoniacal ice and refrigerating devices, has been in use in New Orleans and Texas for several years with much success.

Dyeing Veneers.

It has been found that veneers soaked for twenty-four hours in a solution of caustic soda containing ten per cent of soda, and boiled therein for half an hour, may be, after washing them with sufficient water to remove the alkali, dyed throughout their mass. After being dyed, they must be dried between sheets of paper and pressed to keep their shape. It is stated that if, after the veneers have been treated in this way, they are left for twenty-four hours in a hot decoction of logwood (one part of logwood in three of water), then superficially dried and placed in a hot solution of copperas (one part of copperas to thirty of water they will in twenty-four hours be dyed a beautiful black.

A solution of one part of picric acid in sixty of water, with ammonia added until perceptible to the nose, dyes the veneers a yellow which is not affected by subsequent varnishing; and coralline dissolved in hot water, to which a little caustic soda and one fifth of its volume of soluble glass has been added, produces shades of rose color differing with the amount of coralline used.

The English Patent Laws.

The Select Parliamentary Committee on the Patent Laws have agreed to certain resolutions which they will recommend as the basis of legislation on the subject. They state that the privilege conferred by letters patent promotes the progress of manufactures by causing many important inventions to be introduced and developed more rapidly than would otherwise be the case; and it does not appear to them that the granting of pecuniary rewards could be substituted with advantage to the public interest for the temporary privilege conferred by letters patent. At the same time, the existing laws are defective and require improvement; and the Committee think that protection for a limited period, and dating back to the time at which it was applied for, should only be granted for an invention on its nature and particular points of novelty being clearly described in a provisional specification, and upon the report of a competent authority that such an invention, so far as can be ascertained by such authority, is new, and is a manufacture within the meaning of the law. They further consider that all letters patent should be subject to the condition that the manufacture should be carried on within the United Kingdom, and that it shall be carried into effective operation, within a reasonable time from the granting of the patent, by the patentee or his licencees.—*Pall Mall Gazette.*

On the Heating of Steel.

We believe that overheating has condemned splendid steel more frequently than anything else. "*Make it well hot that it will work easier*" is a common saying, and sounds well in the shop; but when heating steel, don't follow the advice, for although it may seem to work easier when overheated, the error committed thereby will soon become apparent. All cast steel (excepting the comparatively new article, "chrome cast steel," which has properties entirely its own) requires the most careful heating. The fire must be regulated by the size of the work; and in heating the steel, heat the coals around the outside of the fire as soon as the flames begin to break out in order to prevent the heat from escaping. To save fuel, damp the coal and throw water on the fire if it extends beyond its proper limits.

To ascertain the heat of the steel, draw it out of the fire, and that often; for it requires to be well watched to heat it properly, and if not hot enough, thrust it in quickly again; but be careful not to use a higher degree of heat than is absolutely necessary to effect the desired purpose, and to use as few heats as possible. Steel is, essentially iron with a larger ingredient of carbon; therefore, too frequent heating or overheating burns out the carbon, and thus spoils its valuable character. Many smiths have the idea that so long as the steel does not fly to pieces when they strike it with the hammer, it is not too hot; but this is an erroneous idea, and easily proved when it comes to be hardened, and when it is brought into use. We therefore say again, that no forger can be too careful in the heating process, and when he takes the heats. The practical eye will soon learn when it is heated properly for forging. But few forgers will admit that they spoiled the work by overheating, and yet this is unfortunately most frequently the case.

ON THE WELDING OF CAST STEEL.—For welding cast steel, a flux is required in order to prevent oxidation of the surfaces to be joined. For this purpose, use a composition consisting of sixteen parts of borax and one of sal ammoniac, which has been boiled together over a slow fire for an hour, and when cold, ground into a powder. The steel is first heated a little, then dipped in the flux, and the heating continued until the metal has attained the proper heat. The flux is then fused over the surfaces, and has dissolved any oxide of iron which may have formed. The two surfaces to be joined are laid together and struck continuously, working toward the edges in order to expel the flux and insure a perfect union of the metal. Shear steel is joined to wrought iron without difficulty; but when cast steel is to be welded to wrought iron, the greatest care is required, or else no sound welding will be effected. By using the above mentioned flux, it can be done; but in all cases where steel is to be joined to iron, the steel—no matter what kind—should never be heated to so high a degree of temperature as the iron.—*The Hub.*

Secondary Batteries.

It is well known how the Leyden jar discharges, in one strong spark, the sum of electricity it received from the electric machine. M. Planté connects a somewhat analagous apparatus with the voltaic pile. Two plates of lead (20in. long by 8in. wide) are rolled up in spiral, being separated from each other by a few strips of india rubber. This spiral is placed in a jar containing acidulated water, and having a gutta percha cover, on which are fitted binding screws connected with the plates. Twenty such elements are placed in two rows of ten each, and charged from the primary battery, which consists of two Bunsen couples. By means of a commutator of peculiar construction, these secondary elements may be connected either for quantity or for intensity. When the elements are joined in series, an electromotive force equal to thirty Bunsens is obtained, giving a current by means of which platinum wire may be fused.

In the secondary couples, the chemical action generating the current is the reaction of hydrogen on peroxide of lead, the current from the primary pile, having caused decomposition of the water, oxidizing one of the plates and developing hydrogen on the other.

By the above arrangement, the quantity of electric work from the direct action of the primary pile is transformed by condensation. This case is somewhat similar to that of a hydraulic press or crane. In a pile driver, *e. g.*, a heavy body, raised by degrees to a great hight by a series of successive efforts, is then left to itself, and gives back at once the greater part of the work thus expended on it. So, when, after charging, the secondary circuit is closed, the sum of the accumulated chemical actions caused by the primary current is given out in the form of a very intense current of short duration. The effect, when the couples are joined for quantity, corresponds to the fall of a very heavy mass raised a small hight; when joined for intensity, to the fall of a small mass raised to a great hight. It is not difficult to see how these secondary piles may become of important use.

The Mastodon Bones.

At a recent meeting of the Cornell Natural History Society, Mr. Seybolt read a paper on the skeleton of the mastodon lately exhumed on the farm of A. J. Mitchell, near Otisville, Orange county, N. Y. The facts of the case were drawn from the personal observation of the speaker, and were consequently listened to with much interest. The skeleton was discovered December last in a deep wet swamp. The bones found up to the 1st. of April were the ribs, vertebræ, head, pelvis, and bones of the forelegs, indeed all the bones except those of the hind legs, lower jaw and tusks, which undoubtedly will be found ere long. The head is of astonishing size and measures three feet seven inches across the top and over four feet in length. Of the teeth, the back tooth extends seven inches along the jaw and has a width of three inches. The tusk holes are seven inches in diameter and extend three feet into the head. The shoulder blades are each two feet in length and about the same in breadth. And the ribs, some thirty in number, measure in the longest between five and six feet. The pelvis bone, which was taken out entire, measures in its greatest extent five feet seven inches. The skeleton as a whole is supposed to be the largest yet discovered. When set up, it will be fourteen feet in hight and twenty-five feet in length. Twigs of coniferous trees, leaves and other vegetable matters were found between the ribs, and tufts of dun brown hair from two to seven inches in length were found outside. Concerning the deposits in which the skeleton was found, the upper layer, from five to fifteen inches in thickness, consisted of common black swamp dirt; beneath was a layer of coarse, fibrous peat quite dry in its character and varying from two to four and a half feet in thickness; below this was a stratum of coarse marl, a foot in thickness, then a curious layer of grass, matted and quite well preserved; then another layer of marl, below which appeared the clay which is supposed to underly the region roundabout. The bones were found chiefly in the lower strata, but a few occurred in the upper. The swamp is at the eastern base of the Shawangunk mountains, and the under stratum sloped eastward, disclosing sea washed cobble stones and marine shells. The bones are of a brownish color, being undoubtedly impregnated with oxide of iron. No disposition has yet been made of the skeleton, but it will be sold to the highest bidder.—*Cornell Era.*

Adulterations.

While it is very difficult, and perhaps almost impossible, to detect the finer kinds of adulteration in the case of liquors, we are fortunately able to follow the adulterator of the ordinary articles of food, and to detect his practices with certainty. Add perfectly odorless spirit to brandy, and although the adulteration is notable and profitable, it is beyond the reach of the chemist. Add chicory to coffee, and although the chemist fails to point it out with certainty, the microscopist is not so easily balked. Before the searching power of this wonderful tube, the secret operations of the adulterator become as obvious as if performed in full view; for the microscope reveals to us the ultimate structure of the different vegetable and animal substances, and as each has its own well marked characteristics, it is as easily recognized by the expert as are the faces of his friends by an ordinary observer. No one who has ever seen potato starch could readily mistake it for anything else; chicory and coffee are so unlike that the difference is instantly perceived, and the smallest addition of either one to a sample of the other is readily detected. So, too, in regard to many sophistications of a purely chemical character. Red lead, added to vermilion, is easily separated; sulphuric acid, or oil of vitriol, when used for the purpose of increasing the strength of vinegar, is readily recognized; sugar, when adulterated with sand, may easily be made to give positive evidence of the presence of the latter; the coloring matter employed for the purpose of converting worthless tea leaves into the "best" green tea, may without difficulty be identified; and the mineral matter, such as *terra alba*, or farinaceous substances such as wheat, corn or potato starch, used for the purpose of increasing the bulk and weight of confectionery, may be determined. There is a wide range of cases in which adulterations may be detected with ease and proved with certainty. Some of the tricks of the wily adulterator show a marvellous ingenuity. Thus some persons, knowing that most ground coffee is adulterated, never buy the ground article, but always procure the whole beans, which they either grind themselves or get ground. To meet this case, the adulterator makes up a paste of ground chicory, pea flour, and other cheap materials, and molds it, by machinery, into the form of the beans. These artificial beans are rolled in a barrel until smooth, roasted to the proper color, and mixed with a small proportion of genuine beans, to give them the true coffee flavor. The fraud is of course easily detected, as such beans quickly fall to powder when soaked in water; but this example shows the ingenuity and painstaking of the fraudulent classes, who often spend, in efforts to cheat, an amount of labor and ingenuity that, if devoted to some honest undertaking, would be certain to insure success.

Any attempts to suppress the practice of adulteration must be based upon certainty of exposure and punishment. How many children are robbed of their due amount of nutriment by the vile practice of watering milk? How often is the physician disappointed in the effects of the medicines that he prescribes, simply from the fact that these medicines are not pure, some dishonest and avaricious druggist having adulterated them with cheaper and less potent materials, in order that he might make a little gain?

We feel satisfied that the practice of adulteration will never be completely and permanently checked until the government takes the matter fairly in hand, and enacts efficient laws looking to the detection and punishment of this crime. —*Professor Phin, in Good Health.*

A SCHOOL house in Copenhagen, Denmark, is furnished for 1,000 children; one session is held in the morning, 1,000 attending, and a second in the afternoon, 1,000 attending, both schools being under the same general management. The system secures a happy union of bodily and mental exercise, the scholars working half the day.

A NEW tin tea kettle takes a longer time to boil than an old one, because the bright surface reflects or throws off the heat of the fire; but the old one, having a dark surface, absorbs the heat.

Improved Cooking Vessel.

For some time past, we have employed in our domestic establishment one of Warren's improved cooking vessels, and find it to be an important and valuable addition to the culinary service. It is, in fact, an automatic cook, and performs its allotted duty with a great deal better judgment and far less fuss than the best forty-dollar-a-month French cook that ever officiated over a stew pan.

The patent cook consists of a series of combined vessels, and, in using it, you simply place your roast beef, steak, mutton, ham, fish or game and the various vegetables, each in its separate division, and set the vessel on the fire; where it remains for a specified time without any attention. It cannot burn, over do or under cook, but when the time is up, you have the finest cookery that can be imagined, executed on strictly scientific principles. That is to say, the cooking is done at a temperature of not over 210° Fah., which, according to Liebig, is the correct heat. A higher temperature coagulates the albumen and renders meats tough and stringy. This machine is not a steamer but a roaster; but you can make it a steamer, if desired, by shifting one or two of the covers.

By the ordinary methods of cooking, one third of the original weight of the meat is lost by the evaporation of the juices; but with this improved device this loss is to a great extent prevented, and the cooked food is greatly improved in quality. Made by the Newport Lead Works, Newport, R. I.

A Hint to Nurses.

You know what a racket is caused, even by the most careful hand, in supplying coals to a grate or stove, and how, when the performance is undertaken by the servant, it becomes almost distracting. If you don't remember, take notice the first time you are ill, or you have a dear patient in your care, or the baby is in a quiet slumber. Let some one bring on her coal scuttle or shovel, and revive your recollection. Well, the remedy we suggest is to put the coals in little paper bags, each holding about a shovelful. These can be laid quietly on the fire, and, as the paper ignites, the coals will softly settle in place. You may fill a coal scuttle or box with such parcels, ready for use. For a sick room, a nursery at night, or even for a library, the plan is admirable. Just try it. Besides, it is so cleanly. If you don't choose to provide yourself with paper bags, you can wrap the coals in pieces of newspaper at your leisure, and have them ready for use when occasion requires.

Preparation of Beet Leaves for Fodder.

Méhay maintains the entire success of his method of so preparing the leaves of the beet as to render them capable of preservation for several months as fodder, and at the same time greatly improving their qualities as food for cattle. The method consists simply in placing them in baskets and immersing them in a tank containing diluted hydrochloric acid of 4° of Beaumé. The result of this is to greatly condense the volume of the leaves, and to render it necessary to add more fresh ones to fill up the basket, which has to be again immersed, and finally allowed to drain off. The leaves may then be placed in beds, in dry earth, and kept until needed for use. According to a report of a committee who examined the results of this process, domestic animals become extremely fond of the leaves thus prepared; and, indeed, milch cows fed with them are said to give a large increase of milk, with a decided improvement in the quality of the butter. The tendency to diarrhœa in cattle produced by the fresh beet leaves seems not to be developed by this prepared fodder, and for this and many other reasons it is strongly recommended to agriculturists.

Source of Nitrogen in Plants.

It is well known that the quantity of nitrogen contained in the crops exceeds in enormous proportion that existing in the manures, the excess undoubtedly being derived from the air. It is now a question whether this is extracted directly from the air by plants, which would thus have the power of assimilating directly, or if it is first taken from the air by the soil, so as to combine with organic matter and form an assimilable compound. According to Deherain, oxygen, in the presence of organic matter, combines directly with nitrogen to form a compound analogous to the humus of the earth, or to ulmic acid. To illustrate this, he placed in a tube oxygen, nitrogen, glucose, and ammonia. On drying the tube and heating it, a black, nitrogenized matter was left, and a portion of the nitrogen in the tube was found to have disappeared.

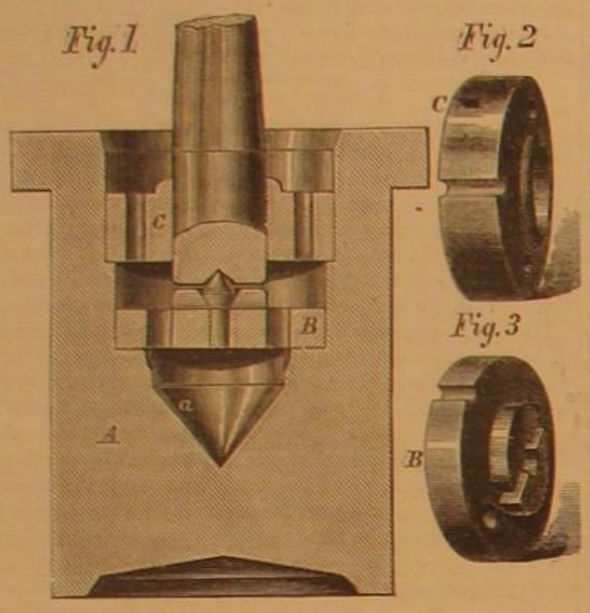
REGULATING THE HATCHING OF SILKWORM EGGS.—Duclaux, after a careful observation of the external conditions which favor and influence the hatching of the eggs of silkworms, has prepared the following rules, by attention to which it is said that the development of the eggs can be regulated at will. First, to prevent an egg from being hatched at the usual time, it must be kept, from the period of being laid, at a temperature between 59° and 68° Fahr., and then exposed fourteen days to cold, three months before the time at which the hatching is desired, being subsequently treated in the usual manner. To cause an egg to hatch before the usual time, it must be exposed to cold twenty days after being laid, and kept in that condition for two months, and then removed. Six weeks later it will be in the same condition as ordinary eggs, and can be treated in the same manner. In this way it is possible to have silkworms ready for hatching at any season of the year.

THE actual duration of a flash of lightning does not exceed the millionth part of a second. But the retina of the human eye retains the impression of the electrical flash for a much longer period.

MILL STEP.

This invention furnishes a step for millstone spindles, or any vertical shaft running at a high rate of speed, which prevents the heating of the parts coming in frictional contact and protects them from cutting and wearing rough. Fig. 1 shows, partly in perspective and partly in section, the arrangement of the parts.

A is the box, which incloses and supports the other portions, and which is provided with the chamber, *a*. B (shown in perspective in Fig. 3) is the plate upon which the spindle or shaft rests; and C (shown in perspective in Fig. 2) is a ring encompassing the shaft. The plate, B, and the ring, C, will be observed to have holes through them, and they are each provided, as seen in Figs. 2 and 3, with a groove at the side by means of which they are keyed in position in the box. The plate, B, is grooved across its upper face. The spindle is steadied by a loose pin resting in a central hole through the step plate, as shown in Fig. 1. In operation, the oil used runs down through the holes in the ring and plate and fills the groove across the face of the latter, by which means the bearing is kept well lubricated and free from the action of



grit or dust, etc., all such substances passing through the holes into the chamber, *a*.

The invention was patented May 2, 1871. For further information address the inventor, Mr. Lewis Marsh, P. O. Box 1,579, Minneapolis, Minn.

Bone Setting.

Bone setting is not the art of resetting broken bones or dislocated joints; bone setters are not surgeons, or regular practitioners in any sense of the title; and their patients, even when they have suffered injury to joint or bone, have been pronounced by the regular practitioner cured before seeking the help of the bone setter.

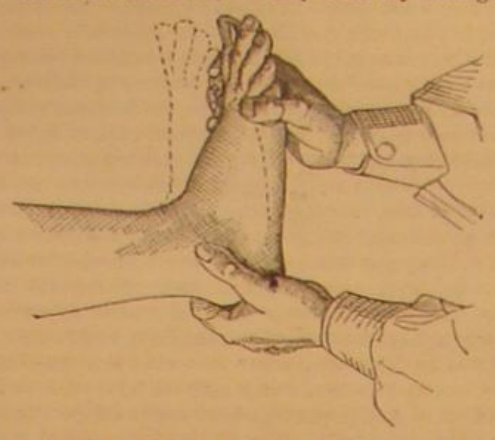
"A healthy man sustains a fracture of one or both bones of the fore arm, and applies at a hospital, where splints are adapted in the usual way. He is made an out patient, and the splints are occasionally taken off and replaced. After the lapse of a certain number of weeks, the fracture becomes firmly united, the splints are laid aside and the man is discharged as cured. He is still unable to use either his hand or his fore arm, but is assured his difficulty arises only from the stiffness incidental to long rest of them, and that it will soon disappear. Instead of disappearing, however, it rather increases, and in due time he seeks the aid of a bone setter.

The answer of the irregular practitioner, that is, the bone setter, is precisely the opposite, namely, that freedom can only be restored to the stiffened joint by movement, by manipulation, and manipulation too of the most formidable kind, nothing less than suddenly and forcibly rupturing and tearing asunder the adhesions formed between the articulating surfaces of the affected joint, an operation which is so frequently successful that it forms the very basis of the bone setting craft.

It is here that the bone setter steps in front of the scientific surgeon, and we must confess to a feeling of disappointment that their relative relations are not reversed, that the surgeon is not called in to rectify the malpractices of the quack instead of the latter being sought out to complete the shortcomings of the former. Let us see how this manipulation is performed. The bone setter has a clearly defined system of treatment for each separate joint, if not for each specific affection to which each joint is subject. One example may here be given:

"The proximal side of the affected joint being firmly held, and the thumb pressure made in the ordinary way, the tarsus is so grasped as to give the greatest attainable leverage, the foot twisted a little inwards or outwards, then sharply bent up upon the leg and again straightened. As a rule, it is desirable to execute this manœuvre twice over with an inward and once with an outward twist, and also to take care that the movements of the joint are free in all directions."

Bone setters, we are told, are for the most part uneducated men, wholly ignorant of anatomy and pathology; but we are not told what we greatly wish to know, and that is, the manner and method in which the secrets, the mysteries, and the traditions of their craft, are communicated to each other. No doubt there exists a freemasonry in the craft, so that when individual members meet revelations are made and notes compared, bu we are not informed of any regular or organized system of instruction, either for the maintenance and extension of the craft, as a craft, or for the enlightenment of the separate and detached members of the fraternity. The most celebrated, we may even say distinguished,



bone setter of our day was the late Mr. Hutton, whose successful treatment of cases that had baffled the skill of the foremost surgeons now living (cases related in detail by Dr. Hood, and about the accuracy of which there can be no question or doubt) is little short of marvellous; and the question is ever recurrent while we read: "How and where was this skill acquired?" for a bone setter of Mr. Hutton's caliber could put his finger on the spot where lurked the seat of an affection that had crippled a patient for half a dozen years, and had defied the scientific treatment of the ablest surgeons of our time; nay, he could point to this spot without ever seeing the limb affected, guided merely by observing the attitude, gait, or action of the patient. Now, whence comes this undoubted skill of these illiterate men? It appears to be obtained solely by observation of symptoms and results of treatment, the accumulated knowledge of from day to day experience; and as we often see that one sense is quickened and functional power increased by the loss or impairment of some other sense, so perhaps the narrowing of the field of instruction, the limiting of the sources of information, may have intensified the powers of observation of the bone setters, atoning in a measure for the absence of the revelations of science.—*Nature.*

RIVETING DEVICE.

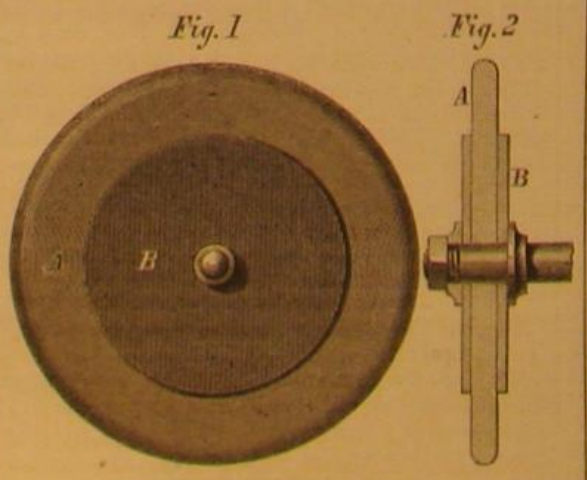
The annexed engraving represents a new tool for fastening copper rivets in leather, which appears to possess some merit. It will be seen from the cut to consist of a handle carrying a head somewhat resembling a hammer, and a punch or plunger attached to it, for security's sake, by a strap. The head has a cylindrical hole through it, the margin of which, at the lower side, is made slightly concave. The punch or plunger fits the hole in the head loosely.

In using the tool, the rivet is put through the leather and the washer placed upon it; the head of the rivet is then laid upon some hard substance, and the lower side of the tool head placed upon the washer, in which position the end of the rivet enters the cylindrical hole. A blow upon the upper side of the tool head drives the washer down snugly upon the leather and draws the rivet head flat. The punch or plunger is then inserted in the hole, and a blow upon the upper end heads down the rivet evenly and smoothly.

Patented through the Scientific American Patent Agency, for the inventor, Mr. Thomas J. Allison, of Turnersburg, North Carolina, of whom further information may be obtained.

STRENGTHENING EMERY WHEELS.

The improvement illustrated in our engraving relates to



the construction of emery wheels which are used for the grinding and polishing of metals. It consists in the application of disks of rubber, leather, or other elastic or flexible material, to one or both sides of the emery wheel. Fig. 1 is a side view of the wheel, and Fig. 2 a vertical cross section of the same.

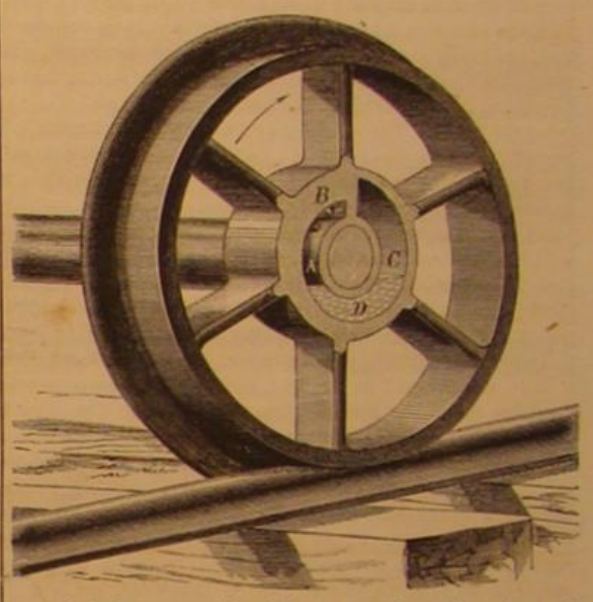
A is the emery wheel, and B is the disk of suitable material, which is made to adhere to the wheel by means of glue or other cement.

Thin emery wheels are in great danger of bursting if run at high speed, and, though very useful in the mechanic arts, are not used as often as they would be, or are run at low speed, on account of the risk attending them. The application of these disks strengthens the wheel and prevents its bursting when revolving at a high rate of speed.

Patented through the Scientific American Patent Agency, May 14, 1872, by Walter S. Jarboe. Further information may be obtained by addressing Union Stone Company, 29 Kilby street, Boston, Mass., or 93 Liberty street, New York.

PEART'S PATENT PIT CAR WHEEL.

Annexed we give a representation of this wheel, with the hub in section so as to show its interior arrangement. The object of the invention is to perfect the lubrication of the working parts. C is the oil reservoir, and D the oil placed in it. A is the hole to convey the oil to the shaft. B is a



spurt hole from one side of the reservoir to the other. On starting the revolution, the oil reaches the journal in sufficient quantity for lubrication, and the supply is stopped by the centrifugal force developed by the wheel when fully under way. The spurt hole, B, relieves the surplus oil on either side by allowing it to pass through. The wheel can also be used as a loose pulley; in which case the direction is as shown by the arrow, and the spurt hole, B, is closed. The advantages claimed are that thin oil can be used and no more of it consumed than absolutely needed; that it requires attention but once a month, and costs no more than other wheels.

Further information may be had of the Atlas Works, Thos. N. Miller, President, Pittsburgh, Pa., who states that the wheel is already used in forty coal mines.

DISCHARGING COAL.

A party of invited guests were recently united to witness the discharge of the barge *Dunderberg*, belonging to the American Coal Barge Company, at the yard of S. Tuttle, Son & Co., Brooklyn, N. Y.

The patent carrying vessels and method of discharge adopted by this company are novel, and greatly improve on the old system. The coal barges, which are 175 feet long, with a carrying capacity of 1,000 tuns, are divided into compartments called pockets. Every pair of pockets is provided with a well hole, over which is placed an improved elevator, so arranged that the coal is automatically fed from the pockets and carried rapidly by the elevator to a chute which in turn conveys it into a building on the wharf. This building, also called a pocket, is raised on posts sufficiently to admit the passage under it of a train of cars or other vehicles, which are loaded from above with great rapidity and convenience.

The old barges, which are about 200 tuns burden, are unloaded by means of buckets and an ordinary derrick, and are unable to discharge more than 25 tuns an hour. The company's barges carry five times this burden, and are discharged by their patent elevator at the rate of from 200 to 250 tuns per hour.

STEAM PROPULSION ON CANALS.

A correspondent, "Tennessee," takes exception to that portion of "Pro Bono's" letter on this subject, published on page 360 of the current volume of the SCIENTIFIC AMERICAN, wherein he stated that "no plan has yet been submitted which is capable of superseding the old system in point of economy." "Tennessee" quotes from the report of Mr. Green, who was engineer to the State Commission, to show the feasibility of carrying on canal navigation by steam with an economy which was altogether foreign to the old system; and he takes the ground that boats have already been designed by skillful inventors which are well calculated to answer all the conditions necessary to the attainment of that end.

THE evergreens at the Central Park, New York, such as the Norway spruce, hemlock, juniper and *arbor vitæ* were badly affected by the severe cold of the past winter. Hundreds of them were killed.

Scientific American.

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EIGHT HOURS' WORK AND TEN HOURS' PAY.

For the past few weeks, the city of New York has been passing through a revolution which, though stamped with none of the acts of lawlessness which have too often characterized similar uprisings, is succeeding in effecting results which may produce important and material changes in the relations of capital and labor throughout the land. Organized bodies, representing nearly every industry in the city, have boldly, firmly, and earnestly demanded the enforcement of a law which is deemed necessary to protect the rights of the working man, to afford him opportunities now denied him for relaxation and self improvement, and to ameliorate a condition under which he chafes, and to which, it is claimed, he has been driven by the encroachments of capital. Questionable advantage, it is true, has been taken of a critical point of affairs. The employer with his yearly contracts uncompleted sees ruin staring him in the face in case of their non-fulfilment, and is consequently forced into acquiescence to demands which he would otherwise unhesitatingly reject. But even in face of this action, although it has doubtless engendered bitter feeling, we cannot but look with satisfaction on this comparatively peaceful revolution in contrast with the acts of atrocity which have rendered the methods of coercion, adopted by the Sheffield and other English organizations, a reproach on the whole system of trades' unions.

The unanimous movement of nearly our entire industrial population, numbering almost forty thousand souls, towards one fixed object must undoubtedly overcome all present opposition, but it remains a question as to what benefits will eventually be attained. To this, the answer can be found, not in the moment of excitement of the present, but in the future when the contest is over and the ordinary pursuits of every day life are in peaceful progress.

It is claimed that the working man when working ten hours per day has no time for recreation or self education, and that owing to the "magnificent distances" which he generally has to travel in this city to reach his place of work, his hours of rest are even further curtailed. Rapid transit will eventually obviate the last mentioned difficulty; but without animadversion on the laboring classes in general, it is but fair to ask who out of the great masses would devote their spare time to the acquirement of useful knowledge. The machinist, the carpenter, are the types of a class who would doubtless labor to perfect themselves in their several callings, but we hardly think it probable that the same would be the case with the large numbers who, without any special trades, are simply "day laborers." These men would be in idleness for a portion of the day and, being without resources or incentives for self improvement, would sink to a condition undeniably worse than that which they at present find burdensome. The record of those countries where the people are most idle shows them to be least advanced in industrial progress. Spain, where the laborer spends half his time sleeping like a dog in the sun, can hardly be compared with the nations of the North, where the artisan works his four "schofts," sixteen hours per day.

The question as to whether the condition of the workman will be bettered, or whether he will be in any measure released from the sway of capital through his working but eight hours per day, is in our opinion at best doubtful. In fact, it appears that the capitalist or the employer is actually, in the end, the gainer. It needs no great perceptive powers to see that, if a manufacturer pays, for eight hours' labor, the same sum that he formerly paid for ten hours, his manufacture will cost him more, and to make any gain he will be obliged to increase his prices. If this be true of large producers, it is equally true of small ones; the grocer, the butcher, all will follow, and the workman will discover that he will have to pay increased prices for his daily wants with precisely the same income that he had before the number of his working hours was lessened.

It might be suggested that he could devote his spare time to some labor whereby he could make up this deficiency. Even if he could so do, he would simply complete the circle, and find himself at the same point from which he started, with a poorer prospect of improving his condition than when he began; but the short sighted policy of the Unions forbids him. From the reports of late proceedings, we learn that the application of a well known manufacturer for permission to employ his men for over eight hours daily, coupled with an agreement to pay them extra compensation for extra time, was peremptorily refused. This we consider an assumption of power which is both illegal on the part of the Unions and unjust toward their several members. Not only does it embitter the feud between employers and employed, but it tends to destroy what seems to us as the fairest and most equitable method of settling the present difficulty and preventing its occurrence in the future. If every man worked by the hour, he could labor six or sixteen hours per day just as he chose; did he wish more time for self education, he would have but to take it; or, was he driven by poverty, extra work would enable him to attain independence.

We uphold the right of working men to associate and form Trades' Unions or Cooperative Societies as they think proper, but when they essay to restrict the right of every one to sell his labor to whoever will pay him most for it, to place the poorest work on a level with the best, or to dictate as to the amount of work which shall be performed in any space of time, we maintain that their action is both arbitrary and unjust, and that its tendency is only to defeat that cause which it should be their sole aim and endeavor to promote.

INFORMATION ON GUM COPAL.

As every day more uses for the resins and gums, of which copal is one of the most important, are discovered, and as a difference of opinion even exists in regard to its properties, one correspondent recommending to dissolve it in alcohol (question 7, page 233, and an answer on page 281), while another correspondent reports that he finds "that alcohol will not dissolve copal," it may be desirable to give some information in regard to this important substance.

It is unfortunate that no proper distinction is made between the use of the words *gums* and *resins*. We should like to confine the first name to all those vegetable exudations which are soluble in water, as gum arabic, gum tragacanth, etc.; while we would call resins those which are insoluble in water, but soluble either in alcohol, ether, turpentine, or their equivalents, as is the case with common resin, and thus not speak of gum copal, gum dammar, gum lac, gum elastic, etc., but call them resins. Some of these, however, consist of a mixture of a gum proper with a resin; such is the case with gambouge, assafœtida, and a few others; but the so-called gum copal is a true resin, insoluble in water.

There are four kinds in the trade. (1.) The Brazilian and West Indian copal; (2) the African and East Indian copal, collected chiefly in Madagascar and the neighboring region; (3) the North American copal; (4) the soft or false copal, which comes sometimes from Brazil, and is sometimes found mixed with the East Indian copal. Fossil copal, found in the clay at Highgate, near London, England, and in the auriferous alluvium at Bucarmanza, in the province of Soccore in New Granada, is also sometimes received from the East Indies, and is not to be confounded with the resin which flows from the copal trees on to the ground between the roots; and being very impure, full of earthy material, is sometimes also called fossil or mineral copal.

The copal as found in commerce consists usually of flat rough pieces of different shapes and sizes. The physical properties are by no means uniform, varying with its origin. Generally, the pieces are not clear outside, but inside clear and either nearly colorless, yellowish, or brownish, and including insects or parts of plants; sometimes the pieces are so dark colored as to be only slightly translucent. Their substance is quite hard, shows a very smooth and conchoid fracture, is easily pulverized, and does not stick together again, even when chewed. At 122° Fah. it becomes slightly soft. The specific gravity varies from 1·045 to 1·14, and it thus sinks always in water.

The properties of the different copals in regard to solvents are found to be very various, according to the origin; the American copal, for instance, is much less soluble in alcohol and oil of turpentine than the East Indian copal. But the copal takes oxygen from the air, or oxidizes, especially when pulverized and kept long in a dry, warm, airy place; and then it becomes much more soluble in alcohol and oil of turpentine. The solubility also increases by melting at as low a temperature as possible; but the American copal is more difficult to melt, becomes darker, and often remains after all so insoluble as to be totally unfit to make varnish of. Sometimes such copal may be dissolved when pulverized, or placed in a bag and exposed to the vapors of hot alcohol, when the soluble portions slowly dissolve out and drop in the liquid below; the previous solution of some camphor in the alcohol has been recommended. Unverdorben recommends to digest two parts copal with three parts of absolute alcohol for twenty-four hours; the insoluble portions will then dissolve in the concentrated solution of the soluble parts. But with some kinds of copal, this does not succeed. In ether, the copal swells up into a sirupy mass. Heating this and adding slowly small portions of hot alcohol of 0·82 specific gravity, a clear solution is obtained; if, however, the alcohol is added cold and at once, the copal precipitates, and can no more be dissolved.

Petroleum dissolves only one per cent of copal, turpentine a little more; two parts of copal form with one part of turpentine a thick fluid mass: and on adding more turpentine, the copal coagulates. The pulverized and oxidized or carefully melted copal dissolves more easily in other etherial oils. The best way is to melt the copal in a glass flask, at as low a temperature as possible, and to add gradually turpentine heated to 212° Fah.; if the latter be added too suddenly, the operation fails. Bisulphide of carbon dissolves copal only partially; oil of caoutchouc better, even without heat. Concentrated sulphuric and nitric acids dissolve the copal perfectly; but by a slight elevation of temperature, a decomposition and destruction takes place.

Alkaline solutions dissolve copal easily, by help of heat, and a peculiar aromatic flavor is perceived. However, such a solution cannot be used for varnish, as it becomes milky on cooling; even the clear gelatin, made by ammonia dissolved in alcohol, is a clear solution which becomes as white as chalk when dry.

Finally, chemical analysis has shown that copal consists of half a dozen or more resins, of different qualities mixed in different proportions, and which have been called after the letters of the Greek alphabet, *alpha* resin, *beta* resin, *gamma* resin, etc. They have been analyzed by Unverdorben and found to possess quite different properties in respect to composition, chemical and physical characteristics, solubility, etc. But none of the copal resins can produce succinic acid, as is the case with the amber, which is much like the copal, but is, as is well known, a fossil product of more uniform properties and easier solubility.

The so-called gum dammar is very much like copal, and is often sold for the same, and is even preferred for its greater solubility. The varnish is not so hard, however. It must be well dried, otherwise it gives no clear solution. The solution is easily performed in two to three parts of boiling turpentine, then diluted with thick turpentine or boiled linseed oil.

THE UNITED STATES SENATE ON COMPENSATION TO INVENTORS.

The United States Senate lately proceeded to the consideration of the House bill directing the Secretary of the Navy to pay to R. M. Green the sum of $10,000, as payment in full for the use by the Government of his patent machine for bending chain cable links and connecting shackles, and tackle hooks.

Mr. Cragin stated that a board of officers had examined into the matter and had estimated that the use of the machine in question in the Washington navy yard, where Green is a mechanic, had saved the Government during the last four years $40,000 in labor alone. He thought the sum proposed very small, as the board had reported the machine as worth $50,000.

Mr. Logan wished the bill amended so as to purchase the patent itself, and not merely the use of the machine. He said the universal practice in the Government navy yards, which he did not justify, however, had been to require mechanics to assign the use of their patents to the Government for the consideration of one dollar. Army and navy officers were not entitled to a royalty from the Government for any invention or patent of their's. He considered this bill violated this general principle, and that the sale of the patent itself should be made absolute if the money were appropriated.

Mr. Ferry, of Michigan, said it was well known that the mechanics, who are taxing their brains by inventions for the benefit of the Government while in its employ, are paid only the wages of daily labor, and if they were treated in the way described there would be no stimulus to them to try to economize either time or money. He believed the just course would be to fix a fair, moderate compensation to the mechanic, that he might be stimulated to invention.

The further consideration of the bill was postponed.

The bill authorizing a settlement of the claims made by the estate of the late Rear Admiral Dahlgren was afterwards taken up, and read a second time.

This bill proposes to refer the claim of the Admiral's widow, who administers to his estate, to the Court of Claims, whose duty it shall be to hear and determine: first, whether Admiral Dahlgren was the original inventor of the Dahlgren gun and projectiles described in his several patents, and, second, what amount of compensation, if any, his estate is justly entitled to receive for the use of his inventions and patents, and for a full and entire transfer of the latter to the United States. In determining the amount, the court is to take into consideration the facts that, while Dahlgren was engaged in perfecting the inventions for which the patents were granted, he was an officer in the United States Navy, and his time, services, and skill were due to the United States, who paid the expenses of the experiments, etc., made by him.

Mr. Stockton thought that if this bill had been drawn with the express view of meeting the objections made by the Senator from Illinois in the previous case, it could not more perfectly have done so. He thought every difficulty

made by the Senator to the other bill was obviated. It was quite impossible for the Senate committee to fix the sum, supposing Admiral Dahlgren's estate was entitled to compensation, and he could see no means of adjudicating in the matter better than referring it to the Court of Claims.

Mr. Logan said the mere reference of the matter to the Court of Claims would be an admission by the Government that it owed something, and that the Court was referred to to ascertain the amount. They would thereby establish the principle that the use of every invention used by the Government must be paid for. The Dahlgren gun is a good one, it was true; but the fact that it was used in the army and navy to-day did not justify them in paying an amount of money for it, if it were done in violation of a principle that the Government ought to establish. This principle was that where officers in the employ of the government, drawing a salary, devote their time to perfecting inventions, the invention ought to be the property of Government. All his remarks, he said, were made in order to record his protest against the establishment of a wrong principle which would eventually cost the Government millions of dollars.

On the suggestion of Mr. Windham, the Secretary read from an opinion by Judge Holt on a decision given by the Chief of Ordnance, General Dyer, wherein the General took the view held by Senator Logan. The opinion stated "that no precedent has been discovered in which the 'principle' understood by General Dyer to be an 'admitted' one has been in any manner acknowledged. On the contrary, there are believed to have been repeated instances in which the opposite view has been taken by the Government."

Mr. Sherman thought no one could question the fact that Admiral Dahlgren had a property right in the use of his invention. When the government granted a patent, it recognized an existing property right in the patentee for a certain invention, and it had no more right to appropriate that property right than any individual had.

The bill was reported to the Senate without amendment, and ordered to be read the third time.

THE SEWING MACHINE RING IN A NEW ROLE.

The application, made to Congress by the Sewing Machine Ring for the revival of the expired Wilson patent, has utterly failed and the case has been withdrawn. But the same parties have put in another appearance, fully determined to obtain an extension of their monopoly in some shape or other. They have now applied, as the assignees, for the revival of the old Akins and Felthousen patent, which was originally granted Aug. 5th, 1851 for fourteen years, and then extended for seven years. This extended term ends on the 5th of August, 1872, when the patent becomes the property of the public, unless Congress interferes by a special act for its further extension.

The Akins and Felthousen machine, as originally patented, was a crude device, widely different from the present mechanisms. But by reissue, with claims unfairly broadened, and by act of Congress, the assignees hope to be enabled to prevent all other sewing machine inventors and manufacturers from producing their goods. They anticipate that the public will thus be compelled to continue to buy sewing machines, of the Ring exclusively, at exorbitant rates.

In our previous discussions of the sewing machine business, we have shown how gigantic is the monopoly now wielded by the small clique known as the Sewing Machine Ring; how they oppress our poor working people by charging them from forty to sixty dollars for the same sewing machines that they sell, at a great profit, for half the money on the other side of the Atlantic, where they enjoy no patent monopoly; and how they have always opposed other makers and inventors of improved machines, by refusing to grant them licenses on reasonable terms. It is needless for us to go over these charges again. Their general correctness remains undisputed, and they apply with equal force to the Akins and Felthousen case as to the Wilson patent and the other patents controlled by the Ring.

The public is tired of the exactions of these sewing machine monopolists. They have grown immensely wealthy; they have reaped the richest rewards for whatever they have done in developing the business. We earnestly hope that Congress will turn a deaf ear to this new petition, and let the sewing machine monopoly die a natural death.

Fatal Boiler Explosions.

The boiler of the *Epsilon* tug boat exploded at the foot of Burling Slip, East River, New York, at half past one p. m., on Monday, May 27. The captain and fireman were killed; the boat was totally destroyed, the fragments being scattered over the adjacent streets. Several minor casualties occurred from the disaster. It is stated that the boiler was in good repair, having been recently examined and tested.

A new boiler at Philadelphia exploded on the same day, causing one immediate death and fatally wounding one person, besides injuring five others. The engineer was the man killed, and we are informed that he had *chained down the safety valve* to get up steam. Mr. L. Phleger, the well known boiler inventor, discovered the criminal act, and was removing the chain when the explosion occurred. Mr. Phleger escaped uninjured.

AN extensive coal bed of remarkable depth and excellent quality has been struck near Raus, at Schonen, Sweden. At a depth of 566 feet, eleven strata of coal had indeed been pierced, but none of these exceeded in depth 1½ feet. Five feet farther down, however, a bed was struck with a thickness of 8½ feet. The borings have been continued, and are believed to prove satisfactorily the existence of an extensive coal bed.

SCREW ELEVATORS.

One of the earliest and probably the safest form of hotel or passenger elevators ever introduced was the screw elevator invented by the late Mr. Tufts of Massachusetts. It consists of a large revolving screw standing in the center of the hoistway and reaching from top to bottom of the building. To the elevator platform is attached a nut, which fits the screw, and the revolutions of the latter carry the platform up and down with great regularity and perfect safety, the platform being in fact a part of the nut. No lifting ropes are employed, and passengers riding upon the machine, if they understand its construction, enjoy a sense of security which they never can have when they trust their lives to suspension ropes and safety clutches.

In view of these considerations, it is with regret that we learn that the proprietors of the Fifth Avenue hotel in this city have determined to remove the excellent screw elevator, that has served their guests with so much safety and success for many years, for the purpose of putting in a more recent patent suspension rope elevator. We shall miss a good old friend when the screw is gone. It is a noble piece of mechanism, and we always admired its massive proportions and stately movements. It is still in splendid order, capable of useful service for a hundred years to come, and whoever obtains it will possess an enduring and effective machine. It is true that the screw elevator obstructs the platform and moves a little slow. But for passenger use *safety* is the first consideration; roominess of the platform and speed come second. The Continental hotel, Philadelphia, is provided with a screw elevator, the counterpart of the Fifth avenue machine.

The Vienna Exposition of 1873.

The Archduke Rainer, President of the commission for preparing the necessary arrangements for the Exposition of 1873, has, in a circular dated March 20, 1872, made known that the owners of the beet sugar factories and sugar beet farms of Austria have authorized him to offer the following prizes for the best cultivators and machinery for harvesting sugar beets:

1. 1,000 and 500 dollars respectively for the two best beet sowing machines.
2. 250 dollars for the best harrow or land roller.
3. 50 dollars for the best beet weeder.
4. 500 and 250 dollars respectively for the two best beet cultivators.
5. 1,500 and 1,000 dollars respectively for the two best beet harvesters.
6. 100 dollars for the best beet cleaning machine.
7. 100 dollars for the best hoe.
8. 150 dollars for the best tool for raising the roots out of the ground.

All machines and tools competing for these prizes have to be delivered at the grounds of the Exposition prior to the month of March, 1873, excepting the harvesting machines which will be accepted as late as September, 1873. All machines and tools will be practically tried on fields of beet roots and in all kinds of soil, unless specially intended for certain qualities of soil and so specified. Awards will be made not later than November, 1873, but only for machines found to be entirely new and fully answering the purposes for which they are intended.

As regards other machinery intended for the Exposition from foreign countries, information is given that all working machines should be announced at Vienna prior to August 1, 1872.

The Inventor of Puddled Steel.

Anton Lohage, the inventor of puddled or wrought steel, died on April 21st, at Unna, in Westphalia. Being the son of a poor peasant, he was sent to an elementary school, and when twelve years of age, he entered the service of a richer peasant as sow herd, and passed through all the stages of an agricultural laborer. When twenty-one years old, he went to work at a factory, and developed there such skill and capacity that he was sent for two years to the factory school at Hagen, where Director Grothe improved him so much that he could be sent with advantage to the Polytechnic School of Berlin, where he studied for three years, and supported himself, partly by a small purse which was granted him, partly by working as a chemist in a factory. In 1848, he began his trials at the Haspe Iron Works, near Hagen, in Westphalia, and after some time he succeeded in producing steel of good and uniform quality by the ordinary puddling process. His invention was patented, 1850, in England by Ewald Riepe, and introduced at Low Moor; but owing to the quality of the pig iron, its use was very limited in England until, in 1858, Mr. William Clay introduced the process on a large scale at the Mersey Steel and Iron Works, Liverpool. In Germany, about 100,000 tons of puddled steel are made every year, and it forms the principal material for Krupp's celebrated cast steel.

FIREPROOF BUILDINGS.—If you will have wood floors and stairs, lay a flooring of the thickest sheet iron over the joists, and your wood upon that, and sheath the stairs with the same material. A floor will not burn without a supply of air under it. Throw a dry board upon a flat pavement, and kindle it as it lies if you can. Prevent drafts, and, though there will be fires, no houses will be consumed.

YEDDO, the capital of Japan, has lately suffered by a great conflagration. Five thousand buildings were burned, comprising 17 large government offices, 60 temples, 287 smaller government offices, and 4,753 dwellings, shops, etc. 20,000 people were rendered homeless. It is to be hoped that the Emperor will now order some steam fire engines.

Alloys of Copper and Zinc.

These two metals will mix with each other in all proportions. The color of the alloy varies with the proportion of zinc present, from almost copper red to zinc white. The alloys are made by mixing granulated copper and zinc in proper amounts, placing the mixture in black lead or Hessian crucibles, and putting these in a suitable furnace. The alloy must be removed as soon as melted, since by exposure to a high temperature it loses zinc.

Several of these alloys have received distinctive names. Pinchbeck contains 6 or 7 parts of zinc to 94 or 93 parts of copper. It has a reddish color, resembling red gold, and was formerly much used for watches and jewelry. When pale gold became fashionable, the alloy was also changed and it was called oroide; this consists of 10 parts of zinc to 90 of copper. Another alloy which is frequently used as a base for gilded articles is called tombac, and contains from 20 to 30 parts of zinc, and 70 to 80 of copper. Dutch gold, which is used for imitation of gilding, is composed of 14 parts of zinc and 86 of copper. This is malleable, and can be hammered into very thin sheets.

Brass contains 33·3 parts of zinc, to 66·7 parts of copper, varying, however, somewhat from those proportions according to the use that is to be made of it. It has several advantages over pure copper, besides being cheaper. It is much easier to work in the lathe, being harder and not so tough. It will also make perfect castings, which are hard to obtain from pure copper. A little lead is frequently added to brass, as it is not so tough and does not clog the file when containing about one per cent of this metal. Prince metal and mosaic gold are of the same composition as brass.

Ormolu contains equal parts of copper and zinc. Muntz or yellow metal differs from other brass in that it may be rolled when hot; it contains 40 parts of zinc to sixty of copper. The ordinary hard solder for brass may be made by melting two parts of brass with one of zinc.

Sterro metal contains, besides copper and zinc, a little tin and iron; it is very hard and has been proposed as a substitute for yellow metal in sheathing ships. Mallet's brass, which is used for protecting iron from oxidation, contains 25·4 parts of copper to 74·6 of zinc.

A Fowl Obstruction.

A late number of the Des Moines (Iowa) *Register* says: "A singular case of railroad obstruction, and one for which no remedy is provided by the statutes, occurred a few evenings since on the Valley road in Green county. Conductor Livingston's train, when about three miles this side of Grand Junction, in passing through some low country and near a pond, ran into an immense flock of swan, brandt, geese, and other wild fowl. The birds were just about to alight on the track as the train drew near. Their number was so great that the sky was filled with them, and those above pressing down on the lower strata forced them to alight on the car tops. The engine, tender and cars were covered with the fowls, and some even clung to the bars of the cowcatcher. One stately swan had a wing injured in the crush, and then found a resting place on the engine head light, whence he was taken by the engineer. The bird, however, managed to escape from custody near Perry, and jumping from the tender where he had been tied, disappeared in the grass. The raid continued several minutes, quite a number of the aerial army being run over by the train, and some half dozen being captured by passengers and train men. As soon as the birds on top of the flock began to understand the situation, they soared away, followed by the entire covey. Livingston says it was the biggest crowd of dead-heads that ever tried to board his train."

GOOD WOODS.—Do not be above your business, no matter what that calling may be, but strive to be the best in that line. He who turns up his nose at his work quarrels with his bread and butter. He is a poor smith who quarrels with his own sparks; there is no shame about any honest calling; don't be afraid of soiling your hands; there is plenty of soap to be had. All trades are good to traders. Above all things avoid laziness. There is plenty to do in this world for every pair of hands, and we must so work that the world will be richer because of our having lived in it.

SHOW me the person who complains of mental weariness, and I will find in him a torpid liver, obstructed kidneys, a dyspeptic stomach, constipated bowels, or an inactive skin. If the brain worker does not sleep enough, nor exercise enough, nor eat enough, or if he eats too much, or takes improper food, his digestive organs run down, and the clockwork of the brain, having no way to reconstruct the machinery through which it receives impressions and transmits volitions and impulses, is obliged to cease work.

The moral is, in brief, keep the body in health, and the brain will take care of itself, work it all you can.—*Dr. Trall.*

THE corporate authorities of Boston have decided to fill up that large portion of useless harbor mud known as the South Boston Flats. Seven hundred acres of valuable land will thus be reclaimed and added to the taxable property of the city, to say nothing of the augmentation of business and business facilities which will attend the consummation of the improvement.

To light the streets of London, 650,000 gas lights are employed, which consume every twenty-four hours 22,270,000 cubic feet of gas; and if the streets of the metropolis were put together, they would extend a distance of about 4,000 miles.

The Nes Silicon Steel.

Considerable interest has lately been excited by the announcement that a new manner of making steel has been discovered, which, on account of its cheapness and simplicity is likely to cause some great changes in the steel and iron business of this country. This new article is called "Silicon Steel;" and it is claimed for it that it is an entirely new product, differing very materially from any steel heretofore known to commerce. Dr. Charles M. Nes is the discoverer of the remarkable properties of the silicon ore used in the manufacture of this new steel, and the circumstances of his discovery are so romantic that we quote the following account from the *Rome Sentinel* of Jan. 9th:

Dr. Chas. M. Nes, a prominent practicing physician of York, Pa., being called to see a lady who had been struck by lightning, was led to investigate the cause of the attraction of electricity to that particular spot, and found by examination that the electricity had passed down the chimney, thence to a corner of the room where stood a double barreled shot gun, which it had melted down, thence out in the yard to the dog kennel, striking and melting the iron chains with which the dog was secured, and killing him. On examining the melted metal, the doctor was astonished to see the perfect purification and crystalization which had taken place, and conceived the idea of making steel by subjecting the iron while in a molten state to currents of electricity. While thus experimenting, with good results, he was one day hunting on a range of rounded, sloping hills on the Codorous Creek. He shot a pheasant, and stooping to pick it up, discovered a small piece of ore resembling in appearance the melted gun barrel and chain, having the same crystalization and purification. The similarity was so marked that he was led to examine and test its qualities, which he found highly magnetic. He melted some of the ore in a crucible, and ran out a button of very fine steel, which, on being analyzed, was found to be silicon steel, an entirely new product in the steel line, from which the ore derived its name of "Silicon Steel Ore." This led to other and more important experiments, among which was the puddling of 15 or 20 per cent of this ore with common pig iron, in an ordinary puddling furnace. It was surprising to find, as the result, an excellent quality of silicon steel. From that time to the present, he, together with several other scientific and practical men, has thoroughly investigated the whole subject, until it has become clearly and unmistakably established that the mixture of this silicon ore with common iron will produce a quality of steel superior to any in the known world, and at an expense only a trifle above ordinary iron.

Having read the above and some other accounts of the discovery of Dr. Nes, we went a few days ago, to Rome, N. Y., where "The Nes Silicon Steel Co." have established the manufacture of the steel for the express purpose of exhibiting the process, and spent several hours in examining the works and methods. Mr. E. Gulick, the manager, extended to us every facility in his power for informing ourselves, and gave us samples of the ore and manufactured products.

The process of working is briefly this: The silicon ore is first crushed into a coarse powder, then put through a refining furnace, where it is melted and run off into plates of hard metal an inch or two in thickness. Then certain proportions of this hard metal are put into an ordinary puddling furnace with common pig iron, and the whole melted. The silicon makes a very excellent flux in itself, and when this mixture has cooked long enough it "balls up," and is hammered into short square "blooms" under a steam hammer. By using from 3 to 8 per cent of silicon ore with common pig, the iron is merely purified; but if the silicon ore is increased to 15 or 20 per cent, the product is found to be steel of good quality. The "blooms" from the steam hammer can be rolled or hammered into any desired shape. The simplicity of the process is really astonishing. You have but to melt up your materials in certain proportions in any furnace, crucible, or pot you choose, and hammer out a good steel product. None of the expensive special fixtures required in making other steels are needed in making the "Silicon."

We brought home a sample of the refined iron made by this process, and also a piece of the steel. The iron (1 in. diameter, round) we bent double when cold without making a crack on the outside of the bend. It has a fine grain and finishes nicely. Of the steel, we made a "cold chisel." It tempered well, and holds its edge very well indeed. We shall test it further as to its fitness for springs, fine tools, etc. One peculiar property claimed for this steel is that, when polished, it will not rust. The silicon steel has already been tried as a cap to rails. There are said to be now ten thousand tuns of these rails in use on the Erie railway, and thus far with good results. Although the discovery and its consequent enterprises are too young yet to have determined their real worth compared with the old methods, still we are favorably impressed by it and have considerable faith that it will help us in the future.—*Oneida Circular.*

NEW VARIETY OF CUCUMBER.—In *Land and Water* we have a figure and description of what is called the new white spine cucumber. This, when raised on a trellis, grows to an enormous size, one vine having three specimens, each of them three feet in length, besides many others over two feet long. The flesh is said to be very solid, with but few seeds, and the flavor very fine. This method of growing cucumbers is recommended as furnishing a much superior result to that of allowing them to trail on the ground, as they thus grow finer, straighter, and with a larger yield. This new cucumber has the skin perfectly smooth. It is very short in the neck, and it is considered a decided gain to the resources of the vegetable gardener.

Krigar's Cupola Furnace.

Smelting iron in a cupola furnace appears to most people, who see it daily done at every foundery, the simplest thing in the world; it is, however, not so, if due regard is taken to economy and good quality in casting. In a common cylindrical cupola, three essential parts may be distinguished. The upper half or body of the furnace prepares the pig iron and lime which, together with coke, are thrown in at the top for smelting in the middle part or crucible, which is somewhat narrower and provided with numerous nozzles for the introduction of blast, whence the molten iron, together with slag, runs down to the lower part, or hearth, where it collects until it is tapped. When such a furnace is to be started, it is filled to about two thirds with coke and one third with coke and iron; fire is then introduced and the blast turned on, when the molten iron collects in the hearth and replaces the coke of the same. Here it necessarily takes up impurities from the coke and impregnates the latter so much that it cannot be destroyed by the blast; and when the iron is tapped, masses of coke and half melted iron, which are not any longer supported, tumble down in the hearth where they are imperfectly burnt or melted, and cause the iron which collects there to become cold and sticky. These irregularities take place after every tap, and it generally happens that iron, which was at first fluid and gray, suddenly becomes thick and white, and unsuitable for the castings intended. In order to avoid this, Henry Krigar, of Berlin, constructs his cupola so that the lower part, or hearth, is not below the crucible, but by its side, and connected with it by a slanting canal, which is about 3 in. high, 6 to 8 in. long, and as wide as the cupola. This arrangement prevents any coke or half melted iron from falling down in the hearth, which is only accessible to melted iron and slag, and forms for them a kind of sump or receiver, which in no way interferes with the regular working of the two upper parts of the cupola. This very simple construction has proved highly successful, and its great advantages are a saving of fuel, a uniformly hot and liquid iron, and an increased yield per diem, as the regular smelting operation is never interrupted. Kregar's cupola can, therefore, be recommended not only to founderies, but also to Bessemer works, and to such forges as use the Danks puddling furnace with liquid iron, as a uniform heat and quality of each charge are essential for their success.—*Engineering.*

Carbonic Acid.

It is often stated as one of the wonders of plant life, that plants are ablo to do what the chemist has failed to do, that is, to decompose carbonic acid.

While it is extremely difficult to decompose carbonic acid, completely separating it into carbon and oxygen, nevertheless it is quite easy to partially decompose it. If we pass a stream of the gas through a tube containing red hot coals, the coals are burnt at the expense of half the oxygen contained in the carbonic acid, and carbonic oxide is the result. Hydrogen, iron, and zinc act similarly towards it, abstracting half its oxygen.

Potassium burns in it with a red light, producing carbon and carbonate of potassium. This experiment may very readily be shown to a class by taking a tube about three fourths of an inch in diameter and ten inches long, bent at right angles near the upper end, which is sealed in the lamp. A piece of potassium about the size of a pea is introduced into the tube, which has been previously filled with dry carbonic acid over mercury, as all aqueous vapors must be avoided; by inverting the tube, the potassium is lodged in the upper end of the bent portion. If it is now heated by a lamp, the first action is to expel a portion of the carbonic acid from the tube; as soon, however, as the potassium approaches a red heat, it takes fire and burns vividly, completely absorbing the carbonic acid, if it is present in sufficient quantity. Sodium also decomposes carbonic acid, but without taking fire. In the presence of the alkalies at red heat, phosphorus and boron have the same action.

Canned Fruits.

The impression prevails among those who use freely fruits which are put up in tin cans, that they are injured thereby, and this impression is in many cases correct. We have long contended that all preserved fruits and vegetables should be stored in glass, and that no metal of any kind should be brought in contact with them. All fruits contain more or less of vegetable acids, and others that are highly corrosive are often formed by fermentation, and the metallic vessels are considerably acted upon. Tin cans are held together by solder, an alloy into which lead enters largely. This metal is easily corroded by vegetable acids, and poisonous salts are formed. Undoubtedly many persons are greatly injured by eating tomatoes, peaches, etc., which have been placed in tin cans, and we advise all our friends who contemplate putting up fruits the present summer to use only glass jars for the purpose.—*Boston Journal of Chemistry.*

INFLUENCE OF FOOD UPON POULTRY AND EGGS.—The influence of the food of poultry upon the quality and flavor of their flesh and eggs has not generally been taken into consideration; but it is now well ascertained that great care should be exercised in regard to this matter. In some instances, it has been attempted to feed poultry on a large scale in France on horseflesh, and, although they devour this substance, very greedily, it has been found to give them a very unpleasant savor. The best fattening material for chickens is said to be Indian cornmeal and milk; and certain large poultry establishments in France use this entirely, to the advantage both of the flesh and of the eggs.

Official List of Patents.

In consequence of the holiday at the Patent Office on Decoration Day, the list of patents dated May 28th, had not reached us at time of going to press. It will appear in our next issue.

TIN IN NEW SOUTH WALES.—Tin has been discovered in the northern portion of New South Wales. The localities in which deposits have been discovered are at present confined to the Macintyre river, where deposits of ore, mixed with alluvium and of stream tin, have been struck over an area of 10 miles by 12, and to the Oban district, on the first fall from the high table land of New England down to the Clarence river. In the latter locality, it has been almost exclusively stream tin which has been hit upon.

TELEGRAPH BETWEEN SCOTLAND AND CANADA *viâ* ICELAND.—The Danish war steamer *Fylla*, which sailed some days ago from Copenhagen for the Faroe Islands and Iceland, has been ordered by the Danish Government to take soundings and survey landing places for the submarine telegraph line intended to connect Scotland, *viâ* those islands, with Canada.

ERRATUM.—On page 322, current volume (No. 21), we described the proprietor of Motz' expansive pivot as Michael M. Motz, Woodward, Center county, Pa. It should be Mitchell & Motz, at the same address.

A Big Victory for the New Wilson Under-Feed Sewing Machine.—It will delight all the many friends of the Wilson Improved Sewing Machine to know that in the stubborn contest for superiority in samples of work at the Great Northern Ohio Fair, their favorite has carried off the two great premiums, the medal for best six specimens machine work, and the diploma for best specimen embroidery. As the great competition was in these two classes, it will be seen that the Wilson's victory is complete. We knew this would be so. It could not be otherwise. There is no talking down the fact that the Wilson is the best family sewing machine now manufactured, the one capable of doing the best work on any kind of goods and under all circumstances. This award of the highest premium to the work of the Wilson Improved Machine, should and will silence the talk of that large class of sewing machine men who have made this machine the object of their special enmity, simply because it is a moderate price machine and undersells their expensive ones. Go and see the first premium cards on those beautiful samples of work, and remember that you can buy this premium sewing machine for fifty dollars.—*From the Cleveland Herald.* Salesroom, 707 Broadway, New York; also for sale in all other cities in the United States.

Notes & 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.]

1.—RECOVERING SILVER FROM WASTE SOLUTIONS.—I wish to know a practical method of reclaiming the silver from photographers waste, which consists of paper and the water from washings. I want to get it so that I can convert it into the nitrate.—C. O.

2.—TAPER STEEL RODS.—Will some one tell me the best and cheapest way to make round tapering spring steel rods, three feet long, diameters at ends three thirty-seconds and six thirty-seconds of an inch? —A. B. K.

3.—LIQUID FUEL.—Is there any kind of liquid fuel in use, by which I could make steam for a two horse engine?—J. B.

4.—ECCENTRIC WHISKERS.—What is the cause, or what will prevent, whiskers breaking off where they appear to eat through and turn white at the ends as if they had been singed?—A. S. R.

5.—PHOSPHORESCENT OIL.—Will some one inform me if there is any means of rendering oil or any other fluid permanently and continuously phosphorescent, if it is, at the same time, sealed air tight? If the phosphorescence would continue six months or a year, it would answer my purpose; but it must not require agitation or a heat of above 90° Fahr. to produce it.—H. W. B.

6.—PROPAGATION OF ROSES.—Will some one inform me if, by taking a hardy rose bush and budding other hardy varieties to it, it will prove a success? I should like to know how it is done, and the best time to do it.—B.

7.—MITRAILLEUR.—In Luttrell's "Diary," under date January 1690, mention is made of an expedition being fitted out against Ireland, and amongst the munitions taken are "four of the new invented wheel engines which discharge 150 musquet balls at once, and, turning the wheel, as many more; they are very serviceable to guard a passe." Does history repeat itself in this instance, and is this the forerunner of the Gatling and mitrailleur guns of all kinds?—S.

8.—CONDENSER WITH RHUMKORFF COIL.—How is a condenser connected with a Rhumkorff coil? As I understand it, I connected the opposite coats of the condenser with the opposite sides of the contact breaker. It increases the spark, but I cannot keep the break working. It will stop after a few vibrations and requires an impulse with the finger to start it and soon stops again. When the condenser is not connected, the brake operates perfectly. The contact points are tipped with platinum. I tried gold tips with the same success. The coil I made myself. I use five or six Grove's cells for battery.—S. G. S.

9.—TRANSFERRING MOTION.—I wish to run a small circular saw (24 inch) with a turbine water wheel. Is there any objection to putting a drum on the vertical wheel shaft and running a half twist belt from it to a horizontal shaft from which to drive the saw, instead of using cog wheels to turn the angle?—W. F. W.

10.—ACTION OF RUNNING WATER ON LEAD PIPE.—The water used for drinking purposes, in my house, is conducted from a spring in the ground through about 1,800 feet of three quarter inch lead pipe. The water is constantly running, and has a fall of about four feet. I wish to know if the water may be poisonous, or if any of the lead is decomposed by the action of the water in flowing through the pipe?—G. G. E.

11.—WATERPROOFING MUSLIN.—How can I make a light muslin tent waterproof without painting or oiling it? I wish to use this tent in all kinds of weather, and wish it to be light, so as to be easily carried.—W. H. J.

12.—FORCE OF FALLING BODIES.—We have a steam hammer weighing exactly three tuns, including piston and rod; the stroke is four feet, and the hammer falls by its own gravity. What will be the force of the blow, making no allowance for friction? What is the formula for the calculation?—J. E.

13.—SPECTACLES.—Can any of your readers inform me if there is any article in use that is better suited to the human eyes than spectacles, and if the articles called "eye sharpeners" have proved a success or not?—J. Y.

Facts for the Ladies.—Mrs. E. A. Mac Rae, Shoe Heel, N. C., has used her Wheeler & Wilson Lock-Stitch Machine since 1857 with perfect success in every respect, stitching the clothing for 30 colored servants and a large family of whites, and army clothing and hospital bedding during the war, without the slightest repair. It is now as good as when bought. See the new Improvements and Woods' Lock-Stitch Ripper.

"Burnett's Cooking Extracts.—The best kinds extant."—*Sears' National Review.*

Answers to Correspondents.

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.

A. C.—It would not be a bad idea for you to advertise your articles in the SCIENTIFIC AMERICAN. You will find it to be a good investment.

MINERAL SPECIMEN.—To W. M. F.—Your specimen is subacetate of lead with some carbonate.

UNIT OF MEASURE.—To L. W. S.—Your suggestion, that a measure derived from the diameter of the sun should be used, can hardly be called novel. The French metric system is based upon the magnitude of the earth, the meter being the forty millionth part of the estimated circumference measured over the poles; and all the French measures of surfaces and solids, as well as the weights, are calculated from the lineal meter, which is 39·3079 inches, nearly.

PHOSPHATE OF CHALK.—A. H. C., in SCIENTIFIC AMERICAN, May 4, asks how the phosphate of chalk, used in Holmes' signal, is prepared. No such thing as a phosphate of chalk exists; nor is phosphate of lime, which, perhaps, he means, capable of being used in this signal. The substance used is phosphide of calcium. It may be prepared by kneading slaked lime into small sticks like a lead pencil, igniting them, and passing phosphorus vapors over them, at the same time heating the lime. Care is required in this, as in all experiments with phosphorus, to prevent a conflagration.—J. S.

POISONOUS COLLARS.—S. K. should burn the collar and test the ash with sulphuretted hydrogen, or sulphide of ammonium. If much lead is used, as on many business and visiting cards, a drop of sulphide of ammonium produces a black stain.—J. S.

PARIS GREEN OR SCHWEINFURTH GREEN.—This is aceto-arsenite of copper. Mr. Charles Schofield, of Indianapolis, formerly a student in Swarthmore College, Pa., died last summer from inhaling a minute quantity of Paris green, while putting it on potato vines. The composition given in Dingler's *Polytechnisches Journal*, Vol. LII, page 271, is oxide of copper, 31·29 per cent; arsenious acid, 58·65, and acetic acid 10·06. It is thus written:

$$3CuO, AsO_3 + CuO, C_4H_3O_3.$$—J. S.

BLACK BOARD.—Query 17, May 4.—Take shellac varnish, lampblack, and flour emery, mix and apply with a camel's hair varnish brush. If too thick, thin with alcohol.—P. J. D.

POISONOUS COLLARS.—To S. K., query 1, page 330.—Boil a piece of collar in diluted nitric acid. Lead will be indicated by a yellow color on the addition of iodide of potassium, and by a black, on addition of hydrosulphuret of ammonium, or solution of sulphuretted hydrogen.—E. H. H., of Mass.

STAINING HORN.—E. C. S., query 7, page 330, may do this by immersing the horn in a solution of nitrate of silver, and then exposing it to sunlight. Or it may be steeped in a hot dilute solution of bichromate of potash, and then in a decoction of logwood. Staining the hands will entirely depend on their coming in contact with the dye or not.—E. H. H., of Mass.

DISSOLVING WOOL OUT OF MIXED FABRICS.—To J. S., query 12, page 330.—Muriatic and sulphuric acids are nearly useless for this purpose. Boil the rags in a mixture of one part of nitric acid and ten of water, or a little stronger. The cotton fiber, after drying, can be shaken out as dust in a willowing machine, leaving the wool behind ready for dyeing. This is the plan adopted in England and Germany for making "extract," and is used for mixing with wool in many manufactures. This prepared wool, however, will be found to have lost, to a great extent, its felting property.—E. H. H., of Mass.

CEMENT FOR TEXTILE FABRICS.—To E. F., query 18, page 330.—Use a solution of gun cotton in ether, that is, collodion.—E. H. H., of Mass.

REMOVING INK STAINS FROM PAPER.—To R. W. A., query 14, page 330.—The ease with which this is done depends on the composition of the ink. If, besides being a mere tanno-gallate ink, it also contains indigo, as most really first class inks do, it will be an impossibility to remove the stains without destroying the paper. Moreover, printing paper is sized very differently from writing or cheque paper. If the surface is well sized, it may be comparatively easy to obliterate the stains, but in the case of thick spongy printing or book paper, the ferruginous particles of the ink will be so incorporated with the substance as always to leave some stain, whether containing indigo or not. Best English inks contain indigo; hence their value as indelible writing fluids.—E. H. H., of Mass.

SUPERHEATING STEAM.—To R. H. E., query 1, page 354.—Steam cannot be so superheated in metal pipes without decomposition.—E. H. H., of Mass.

ANNEALING STEEL.—To U. E., query 5, page 330.—The best way I have found to anneal small pieces of steel is to take a piece of gas pipe, two or three inches in diameter, and put the pieces in it, first heating one end of the pipe and drawing it together, leaving the other end open to look into. When the pieces are at a cherry red heat, cover the fire with saw dust. Use a charcoal fire, and leave the steel in over night. H. C. B., of O.

HYDROGEN LAMP.—To L., query 13, page 330, current vol. 1st. If the tube emitting the gas does not point upwards, attach another piece of rubber tubing or an elbow of any other tube so as to allow a jet, of the gas to be tested, to flow into the uppermost part of an an inverted wide mouthed two or four ounce bottle. If the gas is making rapidly, or you can see from the lowering of the water in the outer jar that your bottle is probably full, still keeping the bottle inverted, as from the lightness of the gas it will stay in the inverted vessel, remove the bottle gently from the pipe or tube, and apply a lighted match to the lower open mouth of the bottle. If the gas explodes loudly, and no flame remains in the bottle, it is dangerous to light the lamp. If it merely takes fire, and a very light bluish flame plays about the bottle or in it for a few seconds, it is pure hydrogen, and then it is safe to light the lamp. 2d. If you make your hydrogen in a simple bottle or jar, allowing it to pass through a tube inserted in the cork, you cannot stop the formation of the gas by closing the tube. If you make it as J. S. directs on page 298, the apparatus is self regulating, making gas only as you use it out of the inner jar, though the cover of the outer jar must not fit air tight, and there had better be free communication from the surface of the liquid in the outer jar to the open air. 3d. An apparatus of the size J. S. describes, if used often, will need renewing in a very few days—in one or two days—unless you make the cork much tighter than can usually be done. It takes a very close joint to confine hydrogen.—S. H. B., of N. H.

NITRIC ACID STAINS.—To S. H. F., query 2, page 354.—These cannot be removed from cloth, though, if the acid was diluted, the color may be modified by the application of an alkali—say ammonia.—E. H. H., of Mass.

ACIDULATION OF ALE.—To W. H. C., query 4, page 354.—This is the result of the acetous fermentation. The alcohol in the ale, absorbing oxygen from the atmosphere, is converted into acetic acid. The prevention may be effected by excluding the air by a tight bung.—E. H. H., of Mass.

ELECTRO-DEPOSITION OF IRON.—Query 5, page 354.—I quote from Napier's "Electro Metallurgy": "Iron may be deposited from a solution of its sulphate in water with a few drops of sulphuric acid added. Use a weak solution and a small battery."—S. G. S., of N. Y.

NITRIC ACID STAINS.—Query 2, page 354.—Apply very carefully, to the nitric acid stain, *aqua ammonia*. Do not use the ammonia stronger than is necessary to remove the stain.—S. G. S., of N. Y.

VACUUM IN CASKS.—E. H. H., in reply to J. A. P., query 6, page 233, says the weight of the air is more than sufficient to hold up liquor in casks, if the liquor would only stick together; but the liquor slips sideways, and so, although the lighter of the two, comes to take the lower place. And does E. H. H. hold that a viscid liquor, like molasses, can be held suspended in pumps to better advantage, and of course at a higher level than water? The power of the air to resist the descent of the liquor can surely not be at a disadvantage from want of mobility of the particles upon one another, as compared with the particles of liquor. Is it not, rather, that what we call gravitation, as exemplified conspicuously in fluids, is a tendency to a vertical movement—that the air does not seek to enter in, but is forced up by a screw motion of the liquor, which screw motion is prevented when paper or other like firm material intervenes? The liquor, that would otherwise be upheld, descends by dint of a mechanical power, the screw, which is made up of the tendency to vertical motion and viscidity conjoined. The old doctrine that terrestrial gravitation takes a bee line towards the earth's center has, moreover, other phenomena opposed to it; witness the course in its descent of a bullet shot from an exactly vertical rifle. What if we add the variation, from a perpendicular, of the plummet suspended from the collar of a deep shaft?—X.

WIND MILLS.—In answer to several enquiries on this subject, I wish to say: The direct force of the wind acting on windmill sails is resolved into two forces, one acting in the direction of rotation, the other in that of the axis. This latter gives no mechanical effect, but, on the contrary, increases the pressure on the pivot of the wind shaft and causes loss of effect. Your mathematical readers can easily resolve the primary force into its resultants, and calculate the best angle of impulse for the maximum effect, etc. For the benefit of the general reader, who is not so fortunate as to possess these advantages, I give the results of theory and practice, sufficiently accurately for general purposes. In especial cases, requiring care, a competent person should be consulted. A mathematical and practical view of the case can be found in Weisbach's "Mechanics," Vol. II, from which the following *data* are condensed: A windmill sail consists of the arms or whips, the cross bars and clothing. The arm is divided into seven equal parts. The sail commences at the first point of division. The cross bar at this point is made equal to one of these divisions, or sometimes one sixth the length of arm. Each successive cross bar increases in length to the last or outermost, which is made from one third to two fifths the length of arm. The arms are not generally made the center line of the sail, but they divide them so that the part next the wind equals from one fifth to one third of the entire width of sail. Owing to the greater velocity of the sails at their outer ends, the angle of impulse here should be greater than near the center. If the cross bars are put on the arms, commencing at the first division next the center, so as to make the following angles with the direction of the wind or, which is the same thing, the axis of rotation, 63½°, 70°, 74½°, 77½°, 79½°, 81°, 82°, the result will approach a maximum sufficient for ordinary cases. The best velocity at their periphery is 2½ times that of the wind. The power of the machine will vary so greatly that no definite area of sail can be given for a certain power. If actual work is to be done, it is better to always have power enough and to spare, in this as in everything else where power is required. I would suggest no less than 150 square feet of sail to each horse power.—C. A. L., of Tenn.

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Recent American and Foreign Patents.

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

HARVESTER RAKE.—William H. Hurlbut, of Mirabile, Mo.—This invention relates to apparatus connected with reaping machines for the purpose of removing the cut grain from the platform of the machine, and consists in mechanism for operating the rake. The operating lever receives a vibrating motion from the reaper, produced in any of the well known ways, which is imparted to a plate and shaft by means of a curved rod and pivoted bar. This motion is equal to about one fourth of an entire revolution, and the rake is made to describe about one fourth of an entire circle by means of projecting lugs on the plate. In addition to this circular sweeping motion of the rake, it is necessary that it should have a revolving motion, in order to raise and depress the teeth. This is produced by means of a horizontal arm which is rigidly attached to the shaft, a curved arm which is rigidly attached to the rake head, and a connecting rod. As the shaft is vibrated, the rake head will be turned about one fourth of an entire revolution. This raises the teeth of the rake to an upright position when they sweep back from the cutter bar, and the revolving motion depresses them to a horizontal position when they return.

CAP BOX.—Albert F. Gove, of Lincoln, Vt., assignor of one half his right to James Henry Batchelder, of same place.—This invention consists in adapting a cap holder to deliver caps, either with or without flanges. For caps with flanges at the top, such as army regulation caps, the upper edges of the side walls are notched sufficiently to allow them to pass. As such notches do not affect the usefulness of the instrument for caps without such flanges, it can be used for both kinds.

SEED PLANTER.—David Lorriaux, of Ottawa, Ill.—This invention furnishes an improved seed planter, which is so constructed that the dropping device may be operated automatically by the advance of the machine, and so that it may be adjusted to work faster or slower by the driver while the machine is in motion. It consists of various parts and cannot be described in detail for want of space.

SCREW DRIVER.—John A. King, of Jamaica, N. Y., assignor to himself and G. L. Peck, of same place.—This invention is an improvement on that for which letters patent were issued to W. S. Goss, August 4, 1868. The parts composing the ratchet mechanism are so constructed and arranged that they occupy less space and are better adapted to endure severe strain or torsion of the instrument.

CANAL BOAT.—I. Joseph Hilgerd, of New York city.—This invention has for its object to improve the construction of canal boats, so as to enable them to be propelled through the water with greater velocity and without injury to the banks; it consists in the following construction: Two wheels, made in the form of frustrums of cones, placed apex to apex, are attached to the shaft to which the power is applied. They are made air and water tight, and have paddles or blades, slightly inclined or spiral, attached to their conical surfaces. The walls of the forward part of the boat at the sides of the wheels are made double, and air and water tight, to serve as floats to buoy up the bow of the boat. The boat is made with two keels, one upon each side of its bottom. The keels are made air and water tight, to assist in floating the boat. They also form a channel or water course along the center of the boat's bottom to receive the water from the wheels to prevent the banks from being washed by the swell. They also prevent the boat shaking. Two rudders are used—one at the rear end of each keel. They are made triangular in form to prevent them stirring up the sand or mud in the bottom of the canal in shallow water, and are connected by a cross bar to the center of which the tiller is pivoted. The tiller is pivoted to the tiller post at the center of the rear part of the boat. By this construction, the boat draws less water while carrying a heavier load than boats constructed in the ordinary manner, and at the same time the wheels cut down the water in front of the boat and force it inward and rearward through the channel in the bottom of the boat, so that it loses its force before being discharged at the stern, and thus prevents the formation of a swell which might injure the banks, and enables the boat to be propelled faster than ordinary boats can be.

SCROLL SAWING MACHINE.—John D. Powers, of Orwell, Vt.—This invention consists of a hand power scroll or jig saw, in which a cranked driving pulley is mounted with the crank under the right hand end of the saw table, where it can be reached readily by the right hand for turning, while the left hand guides the work to the saw. From this driver a pitman shaft, directly under it, is driven by a belt and small pulley, and a pitman directly under the saw connects with the apex of a triangular frame pivoted at a considerable distance to the rear of the saw, and beyond the pivot connected by swivel jointed rods with the rear of a similarly constructed and pivoted frame, between which two frames, at the front ends, the saw is stretched by the swivel jointed rods. The saw is connected, at the lower end, to a rod, to the lower end of which the pitman is connected; and the upper end is connected to an iron plate capable of rising and falling, in the end of the upper frame, and having a short eccentric lever in the upper end, for raising and lowering it to make the saw fast and loose. A bellows is applied for blowing the dust away from the work, and it is so attached to the working gear that the blast is made when the saw is moving up, in order to divide and equalize the work between the up and down strokes.

CORN POPPER.—Albert F. Curtis and Orin N. Palmer, of Delaware, Ohio.—The corn popping vessel is a cylinder made of wire cloth or perforated metal with tight heads of tin or other sheet metal. One head is stationary, while the other is hinged, so as to open and close. The handle may be of wood or metal and of any desired length. It is connected with the cylinder by means of wires, the ends of which lap on to the handle, and are fastened by a sliding ferrule. The ends of the wires are turned and pointed so that they take hold of shoulders in the handle, and when pressed down the fastening is complete. These wires are bent so as to clasp and hold the stationary head to the cylinder. Other wires bend up and over the head and extend to the cover on the outside of the cylinder, forming the pintle of a hinge for the cover on one side, and a fastening hook on the other. The end of the fastening wire passes through a band at the end of the cylinder, and through a narrow radial slot in the cover near its edge. The hook projects beyond the surface of the cover and catches on the same at the inner edge of the slot, the elasticity of the wire on whose end the hook is formed, serving to retain it in this position. Thus the cover is held or clamped upon the band. To release the cover, the wire is pushed outward, which throws the hook into the slot and allows it to rise. Directly beneath the head, all the wires are brought nearly in contact with each other, where they are confined by a ring.

AXLE.—George W. Ray, of Rankin's Depot, Tenn.—In this invention the wheels are cast with or upon, or are shrunk upon, the ends of the axles or spindles, so as to be a solid part of, or immovably attached to them. One spindle is used for each wheel. The spindles are made long, and revolve in bearings attached to the under side of a wooden bolster. They are placed parallel with each other, and in the same horizontal plane. The spindle, when made long, may be made tapering or of uniform diameter, as may be desired, and they are kept from longitudinal movement in their bearings by collars formed upon their journals and working in grooves in their bearings.

NAIL EXTRACTOR.—Edward A. Franklin, of Brenham, Texas.—The object of this improvement is to produce an instrument for readily extracting nails, tacks, brads, etc., from the matter into which they have been forced, which will increase its effectiveness in equal ratio with the resistance offered by the object under operation. The invention consists in a novel arrangement of levers and claws which cannot be fully described without the aid of a drawing.

DRIVING BIT.—Charles Hule, of New York city.—This invention furnishes an improved horse's bit, which gives the driver full control over the horse, and at the same time is easy upon the horse's mouth; it may be so adjusted as to relieve his mouth when sore, and allow it to heal. It consists in bars, link plates, and rings, so constructed that the bars may be readily adjusted closer together or further apart, or the link plates may be detached and replaced with longer or shorter ones, as may be required. The bars, when in use, lie loosely in the horse's mouth, and the horse is guided by pulling upon the lower one. Should the horse become frightened or be ugly or vicious, by pulling strongly upon the reins the bit acts as a lever to force the horse's jaws apart, and at once subdues him.

MACHINE FOR MANUFACTURING ICE CREAM.—Charles Gooch, of Cincinnati, Ohio.—This is an apparatus designed to be used in manufacturing ice cream in large quantities, and is adapted to the production of different flavors and qualities of the article in a more expeditious manner than heretofore. It consists of an arrangement of a horizontal driving shaft in such relation to a series of vertical driving shafts and parallel horizontal ways, on which the cream receptacles are moved up to and away from the said vertical shafts, to allow their dasher stems to be coupled therewith, so as to adapt the driving shaft to operate the dashers singly and successively, or simultaneously.

GRAIN METER.—Robert Rutherford, of Belleville, Ill., assignor to himself and Jasper Messenger, of same place.—This invention has for its object to furnish an improved apparatus for weighing grain as it comes from a thrasher, elevator, or other place, and consists in the combination of a box and a weighing lever or balance, and various other parts operating together as follows: When enough grain has been received in the box to overbalance the weight, the box descends and at once closes valves which prevent any more grain entering the box until the grain already there has been discharged. When the box has descended sufficiently, other valves drop down, allowing the grain to flow out into a receiver placed beneath the apparatus to receive the weighed grain. As the box is lightened by the escape of the grain and rises, the valves return to their places, closing the lower end of the box to again receive grain. By this arrangement, the operation of the weigher is automatic, and all the attendant has to do is to count the number of discharges to know the exact amount of grain weighed. The counting may be done, if desired, by an indicator connected with the apparatus.

WATER WHEEL.—Levi M. Sharps, of Alanthus Grove, Mo.—This invention furnishes an improved water wheel, which is constructed to utilize the greatest possible per cent of the power of the water, by improving the construction of the buckets so as to produce the best effect, and the construction of the guide chutes so that they may support the weight of the column of water, and deliver it squarely against the faces of the buckets. It cannot be described in detail without the aid of drawings.

WOOD SCREW.—Edwin S. Wills, of 917 Ridge street, Philadelphia, Pa.—The first part of this invention relates to a spoon shaped point to the screw for forming a boring and tapping device, so as to dispense with the necessity of boring the wood previous to the insertion of the screw. The second part relates to a central bore of the screw from the concavity of the point throughout its whole length for the passage of the borings. The accompanying engraving fully explains the device. This screw will not split the wood, as the spoon point cuts through the fibers and the central bore allows ample space for the chips. Machine screws made on this principle are found to operate well. They are made with a square head instead of the slotted head represented in the illustration. In putting ordinary screws into hard wood, the friction attendant upon the thread crowding the fibers out of place is very great, and it is hard work to drive the screw. With the improved screw, the fibers are cut through by the tapping point sufficiently to remove a portion of the friction and to secure easy driving, but not enough to prevent the screw retaining a tight hold on the wood.—Patented April 30, 1872.

BOTTLE CAPPING MACHINE.—August C. Jordan, of New York city.—This invention relates to a machine for quickly and exactly applying tin foil or other thin caps over the corked ends of bottles or jars; and consists in the arrangement of rotary spring jaws for pressing the foil against the neck of the bottle, and of a sliding spring button for holding the head of the cap against the stopple or cork.

MODEL STAND.—George A. Gilbert, New York city.—This invention relates to a new apparatus to be used as a support for models, to be drawn, painted, or otherwise imitated by artists, and also for boards or stretched canvas to be drawn upon. It consists in the arrangement, on an upright rod or post, of a sliding plate and adjustable cross bar, the plate serving as a support for models, the cross bar as a means of steadying wider articles, or to suspend pendent things. By this means, a stand which can be used as a support for all sorts of articles is produced at small cost and in simple form.

BOLT THREADING MACHINE.—George W. Frosst, Richmond, Va., assignor to Archer, Goodwin & Co., of same place.—This invention consists of an automatic reversing and stop motion for machines for screwing thread bolts. It is also applicable for nut tapping machines. The device is composed of so many parts as to render a description impossible unless aided by drawings.

COTTON PRESS.—James W. Miller, Shannon, Miss.—This invention consists of a lever toggle, jointed bars, and a windlass or capstan working the follower, the lever being connected by its short arm to a stem rising up from the follower, and by its long arm to the toggle jointed bars. A capstan is used to force the arms together by a rope and pulleys.

STREET CAR.—John Stephenson, New York city.—These improvements are intended to apply more particularly to the front doors of cars which are under the control of the driver. They consist, first, in suspending the sliding door on ways (which are so placed as to conform to the shape of the car roof) and thereby securing ease of motion; and, second, in providing a sliding car door with sliding panels therein, so that the car may be ventilated, and the driver easily communicated with by the passengers.

FRONT GEAR FOR CARRIAGES.—Charles L. Leonard, Wells' Bridge, N. Y.—This invention consists in the construction and arrangement of the various parts in such a way that the king bolt is supported laterally throughout so much of its length that it is prevented from vibrating or tilting over sidewise, as it does when the hole or tube through which it passes is shallow. Very great strength is obtained, both vertically and laterally, with very light bars and stays, and the king bolt is firmly supported against being swayed laterally in its support by the carriage body.

HORSE SHOE NAIL.—Joseph Jorey, Norwich, Conn.—This invention relates to a new and useful improvement in the construction of nails for shoeing horses, and consists in forming the heads of such nails partly of iron or soft metal and partly of steel or hard metal, so that the heads may be made to serve as calks and be self sharpening, while they serve to hold the shoe to the horse's foot.

TICKET HOLDER.—John W. Rockafellow, Stockton, N. J.—This invention furnishes, for the use of railway or other ticket sellers, a ticket box or holder, so constructed that the withdrawal of tickets may be effected more readily than heretofore. The ticket box may be of any depth, according to the hight of the pack of tickets it is required to hold; and in horizontal section, its internal size will be a trifle larger than the dimensions of the tickets. It is hinged to any suitable support, and has a slot through the lower back, just above the bottom, about as wide vertically as the thickness of a ticket, and also a slot through the front that will allow a ticket to come out. A thin plate or pusher extends into it above the bottom a quarter of an inch, more or less, in such manner that, when the box is swung forward at the bottom, the rear end of the ticket resting on the pusher is brought in front of the end of the pusher, and will fall to the bottom of the box, where it will be thrust out through the slot when the box goes back, so that it can be readily taken hold of to be pulled out.

BAG HOLDER.—Ethel L. Lyon, of Steamburg, N. Y.—This invention consists of a set of hooks or holding points on bars arranged on a table in such manner that the points may be readily brought together over the center of the filled bag to fold the top for tying; when detached from the filled bag they are swung back to the positions for holding the empty bag open by a weight and spring, or other equivalent device. There is a treadle below the table, adapted for supporting long or short bags, to take the strain off the hooks and to raise the bag for detaching it from the hooks.

CHURN.—Josiah Mayes, Oxford, N. Y.—This invention pertains to an improvement in the class of reciprocating churns provided with guides for the dasher, and it consists in the combination of shoes of friction plates with the dasher and vertical guides by which friction is obtained; which, in connection with the agitation caused by the dasher, will bring the butter in a very short time, and will develop all the butter there may be in the milk.

BOW.—Ephraim S. Morton, Plymouth, Mass.—This bow consists of a straight piece of strong wood, and two springs of steel wire, one attached to each end of the central piece. This attachment is made by inserting the inward ends of the springs in holes in the central piece, and connecting their outer ends by the bow string. These springs are coiled, near the ends of the center piece, to give greater elasticity; and beyond the coils they are curved suitably to constitute the bow, and they are made either double or single. The object of having the springs connected to the center detachably is that they may be taken out and packed in a box more compactly than they otherwise would be.

BAND SAW GANG.—William J. McLane, New York city, assignor to himself and Henry Stillman, of same place.—This invention relates to a new and useful improvement in machinery for sawing lumber and marble. The lower pulleys on which the saws run are made fast to the driving shaft, and are arranged on it in the form of a cone pulley. The upper corresponding pulleys are separate, and loose on an arbor. These pulleys are provided with recesses which allow the teeth of the saws to overhang the particular pulleys to which each saw is attached. This arrangement allows the plate of the saw to lie flat upon the pulley, and so that the set of the saw will no interfere. The gangs may be used either vertically, horizontally, or in an inclined position, as may be desired.

SEWING MACHINE.—Carlos Stebbins, Pike, N. Y.—This invention relates to improvements in regulating the tension on the threads used. A vibrating upper thread controller connects with the driving mechanism, and is governed in its movements by a peculiarly slotted double cam; while the shuttle is provided with a plate which confines the thread according to the degree of strength imparted by an enclosed spring.

HEATING AND COOKING RANGE.—William A. Greene, Brooklyn, N. Y.—This invention consists in arranging heating chambers at the sides, back, and front of the fireplace of the stove, in a manner which would require drawings to fully illustrate. It also includes an arrangement of fire brick on the top plates of the oven.

COMPOSITION FOR COVERING CIGAR TIPS.—John H. Harris, of Pittsfield Mass.—The object of this invention is to protect the tips of cigars from contact with the mouth of the smoker, in order to prevent the saliva absorbing any injurious ingredients or injuring the tobacco. The substance used for this purpose is collodion mixed with any adhesive matter, such as gum shellac or rubber. This compound is formed into a paste and applied to the point of the cigar. Being waterproof, it separates the saliva and tobacco in an efficient manner.

PACKING CASE.—Thomas Scantlin, of Evansville, Ind., assignor to himself and James M. Scantlin, of same place.—This invention furnishes a case for inclosing and protecting cans of oil or other liquids or substances in the course of transportation, storing, or sale; and it consists in a case constructed of metal, or of metal and wood combined, provided with a gate for the discharge orifice or spout of the enclosed can. The discharge tube of the can is placed just below the top or end thereof, and projects through the case so that the contents of the can may be discharged without taking it from the case. A gate slides down over the end of the discharge tube so as to securely confine the cork which closes it.

MACHINE FOR SAWING FELLIES.—John B. Zimmerman, of Fort Seneca, O.—This invention consists in improving the construction of machines used for sawing both curved sides of a felly. The frame, gate, connecting rod, crank or driving wheel, and the table, are substantially like the ordinary sawing machines of this character. Two saws are arranged in the gate, as far apart as the depth of the felly to be sawed, so as to saw both the outer and inner curves at once; and they are arranged for adjustment toward or from each other by having the straining bolts fitted in slotted plates to vary them for fellies of different thicknesses; a circular carriage is pivoted at the side of the saws, the pivot being as far from the saws as the radius of the wheel for which the fellies are designed; the carriage is provided with numerous center holes for the pivot pin, to shift it for cutting fellies for wheels of different sizes. Spring clamps are arranged on the carriage so as to clamp the plank to be sawed at each end and hold it while sawing.

ATTACHING KNOBS TO THEIR SPINDLES.—Andrew S. Gray, of St. John, Canada.—This invention consists in the arrangement of a forked spindle, a knob with a tubular shank, and an eccentric or cam which can be turned to clamp the spindle and fasten the knob to it. This arrangement is a substitute for the screw fastening now in use, and dispenses with the necessity of perforating the spindle at certain places to fit the thickness of various sized doors.

GRAIN SEPARATOR.—John L. Custer, of Bonaparte, Iowa.—This invention furnishes an improved timothy and other grass seed cleaner, for attachment to thrashers and separators, and consists in the following construction: To the ordinary framing, casing and vibrating shoe are added a riddle and a carrier or stirrer, by the action of which chaff, stalks, etc., are carried back and the grain separated; part passing down through the machine to the floor or grain box, and the remainder being carried back to the thrasher.

WATER WHEEL.—Tenison Chesher, of West Middleburg, O.—This invention relates to an improvement in water wheels, and consists in a construction and arrangement of parts which cannot be fully shown without drawings. Half the chutes are stationary and half movable, and when the movable chutes are drawn back from the stationary chutes, a wedge shaped opening between them is preserved at all times. The current of water is not broken before it strikes the bucket of the wheel, and the full force due from a small quantity of water as well as from a large is secured.

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How Can I Obtain a Patent?

is the closing inquiry in nearly every letter, describing some invention which comes to this office. A positive answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them: they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

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Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention, if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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Inventions Patented in England by Americans.

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From May 3 to May 13, 1872, inclusive.

CARDING ENGINE.—J. F. Foss, Lowell, G. E. Taft, Worcester, Mass.
CENTRIFUGAL MACHINE.—J. Cattle, Boston, Mass.
CLAMP FOR JOINING ROPES.—T. H. Alexander, Washington, D. C.
COMPOSITION STONE.—J. Anderson, New York city.
COMPRESSING METALLIC ARTICLES.—J. B. West, Genesee, N. Y.
CURING TOBACCO.—J. D. Culp, Gilroy, Cal.
ELECTRIC TORCH.—W. W. Batchelder, New York city.
EYELETING MACHINE.—J. E. Wiggin (of Massachusetts), Middlesex, Eng.
KNITTING MACHINE, ETC.—W. R. Ramsdell and J. E. Crane, Lowell, Mass.
LUBRICATING COMPOUND.—B. French, Rochester, N. Y.
MAKING NETS.—G. B. Lewis, W. M. Ward, East Boston, Mass.
PNEUMATIC SIGNAL.—A. G. Myers, New York city.
PRINTING TELEGRAPH.—T. A. Edison, Newark, N. J.
PUDDLING APPARATUS.—H. A. V. Post.
ROTARY ENGINE.—G. B. Massey, New York city.
SPINNING MULE.—J. Sutherland, East Hampton, Mass.
STEELIFYING IRON.—T. Sheehan, Dunkirk, N. Y.
TRACTION ENGINE.—G. W. Fitts, Philadelphia, Pa.
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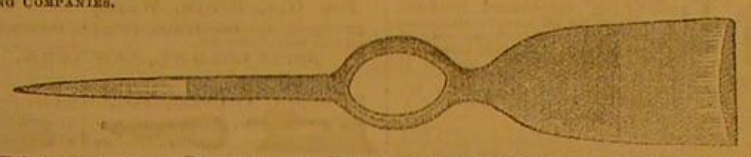

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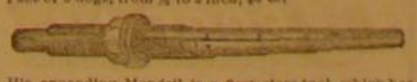

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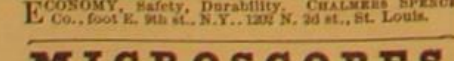

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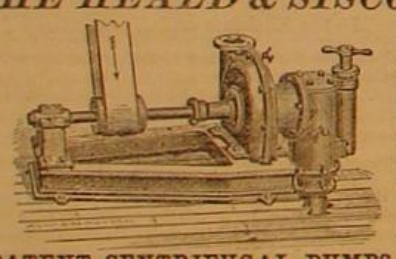

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"First Find a Leader who has Go in Him, then Go and Do Likewise."

The following correspondence explains itself:

COVERT, Van Buren County, Michigan, April 9, 1872.

S. S. WOOD & CO., Newburgh, N. Y.:

GENTLEMEN—Your Household Magazine gives good satisfaction; in fact, those taking it at this office are happily disappointed. And as for the Organ you ordered, we do not wish a better one. The children are perfectly delighted, and children of a larger growth are generally pleased. Perhaps I can no better show our satisfaction in the success of our undertaking, than to send you the inclosed [following], written [for the South Haven Sentinel] by Mr. O. S. SHAW, the leader of our Choir.

Yours truly,

D. B. ALLEN.

How to Do It.

COVERT, March 18th, 1872.

MR. EDITOR:—On the ninth day of January last, a copy of Wood's Household Magazine strayed into the Covert Post-office, and our Post-master, Mr. D. B. ALLEN, who is also Superintendent of our Sabbath School, in glancing over the contents, noticed the offer to any Club, Lodge, or Sabbath School, of a Smith's American Organ for the price of the instrument in subscriptions to the magazine. Here, thought our Superintendent, is our opportunity; we need an Organ, and we need good reading—why may we not have both? The price of the Magazine is one dollar per year, and for one hundred and twenty-five subscribers we can have a No. 1 Organ, price $125. With charcteristic promptness he presented the matter to the school next day, and, though the scheme appeared visionary to the most of us, the ball was set in motion, and it was not suffered to rest until one hundred and fifty-three names were obtained, which, with the addition of twelve dollars in cash, entitled us to a Smith's American Organ, style No. 3, price one hundred and sixty-five dollars. The list, with the cash, was sent to the publishers, the Organ was promptly forwarded, and last Sabbath its powerful tones filled our place of worship for the first time. We can cheerfully testify to the reliability of the publishers of Wood's Household Magazine. They give us our money's worth of valuable reading, and, in addition, a first-class Cabinet Organ; and we will further say to all Clubs, or Societies, that are in want of an Instrument, first find a leader who has *go* in him, then go and do likewise. * * * O. S. S.—[*From the Sentinel, South Haven, Mich., for March* 30, '72.]

WOOD'S HOUSEHOLD MAGAZINE is an original dollar monthly, employing the very best contributors, and an able corps of editors, including Gail Hamilton. Specimen copies mailed free. Address S. S. WOOD.

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SCIENTIFIC AMERICAN

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

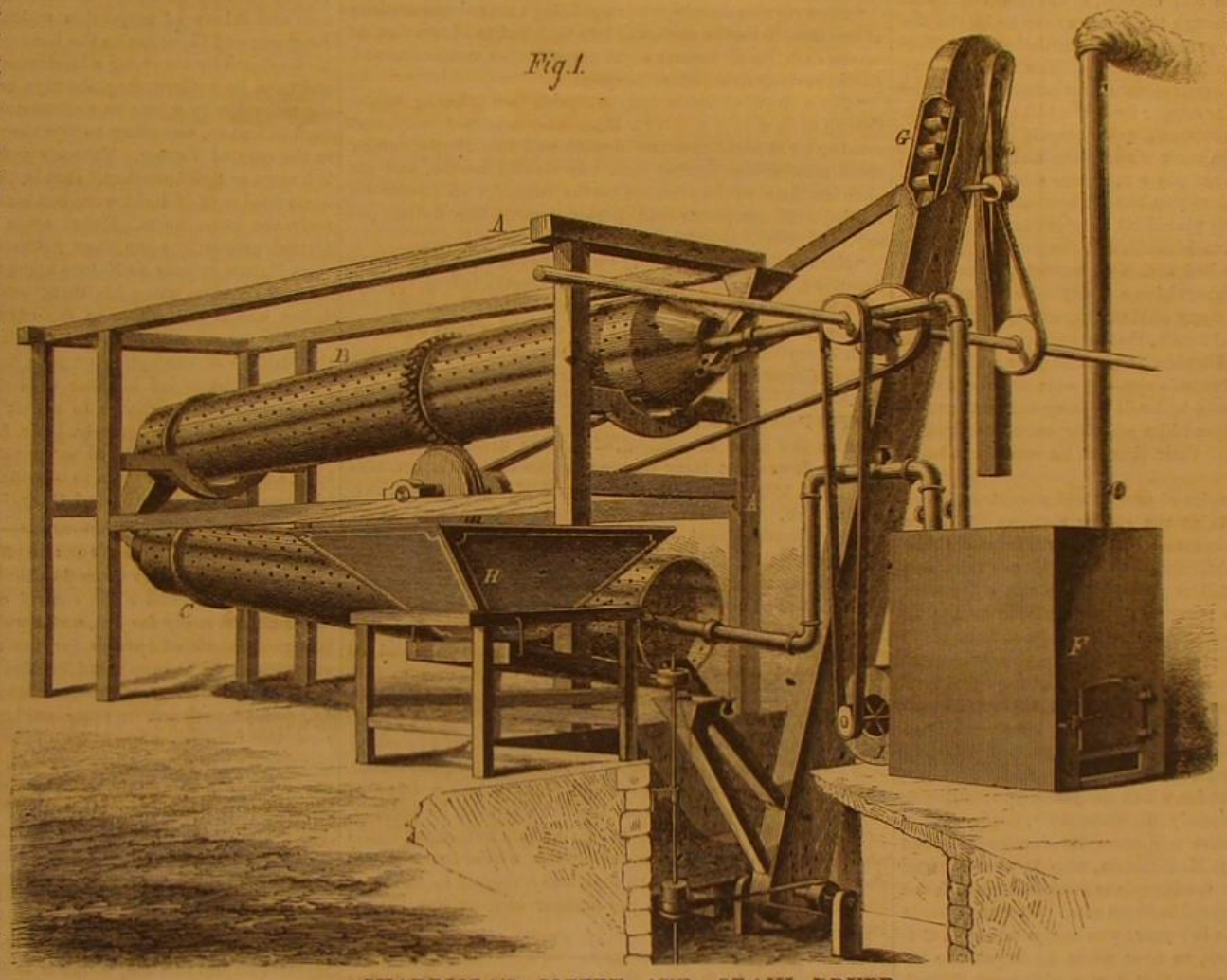
Vol. XXVI.—No. 25. [NEW SERIES.] NEW YORK, JUNE 15, 1872. $3 per Annum, [IN ADVANCE.

Improved Coffee and Grain Dryer.

We this week illustrate a new machine, invented by José Guardiola, of Chocolá, Guatemala, Central America, for artificially drying grain, coffee, malt, etc., so as to prepare it for preservation, transportation, or other purposes. It is more particularly intended to supersede the common method of drying such articles by exposure to the sun, by materially hastening the evaporation of the surplus moisture. It consists of a new arrangement of cylinders, hot air tubes, etc., for drying the grain, and a new construction of furnace for heating the air.

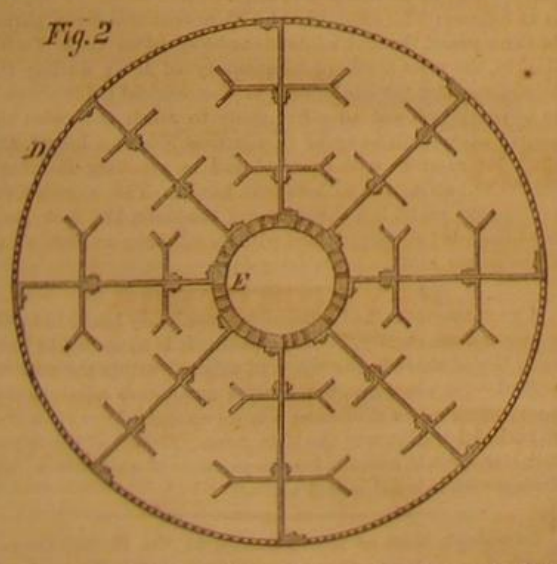
In Fig. 1, A shows the frame of the machine, which serves as a support for two inclined perforated cylinders, B and C. The cylinder, B, is so placed that its lower end is above the upper end of the cylinder, C, and they are there connected by a fixed neck or conduit, as seen in the engraving. The cylinders are supported on small rollers having their supports in the frame, by which means they can be readily revolved around their axes. Rotary motion is imparted to them by a worm gear working in toothed wheels attached to them, one of which is shown at B. Each cylinder contains an inner perforated tube, which is shown in section in Fig. 2, where D is the outer shell of the cylinder and E the contained tube. It will be seen that, between the inner tube and outer shell, there are radial partitions dividing the cylinder into segmental compartments. From these partitions, transverse plates project into the compartments and carry, at some of their ends, wings which are turned alternately inward and outward, as shown in the figure. The partitions and their appendages extend the whole length of the cylinders. The inner tubes of the two cylinders are coupled so that they remain free to revolve with the two hot air flues which project from the heater, F, as shown in Fig. 1. G is an elevator for raising the grain to be dried to the requisite hight; it has one spout extending from the upper part into the open end of the cylinder, B, and another leading downward to a suitable receptacle for the grain. A valve is arranged so as to open whichever spout is to be used, and to shut off the other. From

Fig. 1.



GUARDIOLA'S COFFEE AND GRAIN DRYER

Fig. 2



the lower part of the cylinder, C, a spout leads into the lower part of the elevator. H is a hopper, from which the grain is be dried is conveyed from the hopper over the vibratory shoe to the lower part of the elevator, and thence to the upper end of the cylinder, B. Within this cylinder, it is distributed through the compartments and gradually conveyed to the lower end, from which it passes through the stationary neck into the cylinder, C, where it is again agitated and moved along, while within the cylinders the grain is constantly subjected to the action of the heated air which passes from the perforations in the contained tubes into all the compartments and out through the outer shells. If, after having passed through the cylinder, C, the grain should not be dry enough, it may be reconveyed to the elevator and passed again through the machine, and this may be repeated as often as is necessary. When the required degree of dryness is obtained, the grain is finally discharged through the proper spout into a receptacle provided for it. The cylinders may be revolved five or more times in a minute, or slower, according to the requirements of the case. The temperature in the cylinders is ascertained by a thermometer, and regulated by the quantity of fuel supplied to, and the use of dampers in, the heating apparatus. The complicated motions, given to the grain by the partitions, plates, and wings, cause it to travel a distance of about three miles in an hour, and the evaporation goes on rapidly. Coffee, which contains fifty per cent of water, takes from eight to ten days to dry in the sun; it dries in less than twenty-four hours in this machine. Grain would dry in one or two passages through the cylinders.

Mr. Guardiola is an extensive coffee grower, and has invented other machines of great practical value in curing coffee and like products of Central America. We have been favored with a generous sample of coffee from the Chocolá plantation, worked by Mr. Guardiola, and can personally testify to the plumpness of the berry and its fine flavor when cooked.

We notice elsewhere a coffee huller invented by this gentleman, and we shall present engravings and descriptions of other inventions pertaining to the same industry, from the same source, in future issues.

The invention was patented through the Scientific American Patent Agency, May 7, 1872. For further information Mr. Guardiola may be addressed, care of Ribon & Muñoz, 63 Pine street, New York, or care J. C. Merrill & Co., 204 California street, San Francisco, Cal.

Solvent for Coralline.

The solubility of coralline in an alkaline liquid suggested the propriety of employing soluble glass (basic silicate of soda) which has necessarily always an alkaline reaction, and by the use of which there might be expected to result a compound sparingly soluble in water. The experiment proved successful. Larger or smaller quantities of coralline were dissolved in a boiling solution of one part of soluble glass of a sirupy consistence, previously diluted with four parts of water. Thus were obtained solutions which gave stains ranging from the most delicate rose to the most brilliant carmine. They are well suited for dyeing light colored woods containing but a small amount of tannin, such as Scotch fir, pine, lime, willow, etc. These, without injury to the color, may be subsequently varnished and polished. The same process may be applied to paper intended for the manufacture of artificial flowers, and for a variety of ornamental purposes. These solutions can only be preserved one or two days in a state fit for use. If allowed to stand longer, the silica separates itself out from the soluble glass, the solution gelatinizes, and the color loses its solidity and fire. The tar colors, known in commerce as poncean, soluble in cold water and solutions of soluble glass, form beautiful red liquids, like that yielded by coralline. These, even after long standing, do not deposit their silica, and can therefore serve to prepare a brilliant red ink. Aniline yellow and vesuvine, on the other hand, are less soluble in soluble glass than in water.

GUARDIOLA'S PESTLE FOR HULLING COFFEE, RICE ETC.

Our engraving shows a novel form of pestle to be used in hulling rice, coffee, etc., either by hand or machinery. It is

the invention of José Guardiola, of Chocolá, Guatemala, and was patented by him through the Scientific American Patent Agency, April 30, 1872.

The invention consists in making the pestle, which is conical in form, with projecting ribs of various lengths, thereby forming grooves, in which the grains work their way upward by friction, and are thus divested of the external husks of pellicles it is desired to remove.

The pestle is operated by moving it up and down in the mass of grains to be hulled. The grains are thus crowded into and through the grooves, which, it is claimed, acts effectively to speedily accomplish the hulling.

FROM THE ATLANTIC TO THE PACIFIC.

A recent number of *Harper's Magazine* contains the following interesting description of the cars used on the Pacific Railway:

"From Chicago to Omaha, your train will carry a dining car, which is a great curiosity in its way. I expected to find this somewhat greasy, a little untidy, and with a smell of the kitchen. It might, we travellers thought, be a convenience, but it could not be a luxury. But in fact it is as neat, as nicely fitted, as trim and cleanly, as though Delmonico had furnished it; and though the kitchen may be in the forward end of the car, so perfect is the ventilation that there is not even the faintest odor of cooking. You sit at little tables which comfortably accommodate four persons; you order your breakfast, dinner, or supper from the bill of fare which, as you will see below, contains a quite surprising number of dishes, and you eat, from snow white linen and neat dishes, admirably cooked food, and pay a moderate price.

"Beyond Omaha, unless you have taken seats in a hotel car, you eat at stations placed at proper distances apart, where abundant provision is made, and the food is, for the most part, both well cooked and well served. These hotel stations are under the supervision and control of the managers of the roads, and at many of them, especially on the Central Pacific road—in California, that is to say—your meals are served with actual elegance. Sufficient time is allowed—from thirty to thirty-five minutes—to eat; the conductor tells you beforehand that a bell will be rung before the train starts, and we always found him obliging enough to look in and tell the ladies to take their time, as he would not leave them.

"There is a pleasant spice of variety and adventure in getting out by the way side at the eating stations. We saw strange faces, we had time to look about us, the occasional Indian delighted the children, we stretched our legs and saw something of our fellow passengers in the other cars. Moreover, if you have a numerous party desirous to eat together, the porter will telegraph ahead for you to have a sufficient number of seats reserved; and thus you take your places without flurry or haste, and do not have your digestion spoiled by preliminary and vexatious thoughts about pushing for a good place. In short, these trains are managed for the pleasure and accommodation of the passengers. The voyage would, I suppose, be unendurable else.

"The sleeping car, but for which the journey to the Pacific by rail would be extremely uncomfortable, but by whose help it is made a pleasure trip, owes its development and perfection to Mr. George M. Pullman, who is the inventor and patentee of most of the ingenious devices by which the travel's comfort is secured in these cars. Of course he is an American. He began life poor, was once a miner in Colorado, and was, I believe, so poor when he began the experiment of his sleeping cars that it was with great difficulty he raised the means to build his first car. He is now president of the Pullman car company, which has five hundred sleeping, drawing room and hotel cars on different railroads, and is building more, at the rate of three finished cars for every week of the present year. The company is also building a new kind of day cars, to be put on such short routes as that between New York and Washington; and by the time you are reading this, it will run a daily hotel car from Chicago to Ogden, in which you may sit and sleep, and have your meals served at any time you may choose to order them. It is planning, and will fit up this year near Chicago, extensive car works of its own on grounds large enough to contain also the cottages of the thousand workmen who will be there employed; and it is said that these grounds are to be planned with special regard to the convenience of the men and their families. The company has already found it expedient to keep and furnish, near the depots in all the great cities, rooms where conductors or porters may, at the end of a journey, bathe, change their clothes, make out their reports, and read, write, and amuse themselves. Mr. Pullman thinks that, as he requires much from his men, and as they are picked men, trained with care, it is an advantage to the company to furnish them such a home at the ends of the routes of travel, where they make themselves comfortable and at ease. Certainly it is a humane thought and likely, besides, to give him the command of responsible servants.

"The Pullman cars are constantly improving. The Russian Grand Duke traveled last winter in perhaps the most commodious and perfect manner in which any one ever traveled by rail. He had in one train a day car, in which he and his companions could sit at ease, read, write, or amuse themselves as in a parlor; a dining or hotel car, into which they passed to breakfast or dinner; and a sleeping car. No doubt the impressions he got of this kind of pleasure traveling will facilitate Mr. Pullman's entrance into Russia, where, as well as in England, Germany, and France, the Pullman company will within two years have placed their cars, as arrangements are now making for that purpose.

"The superiority of the American sleeping cars is in their cleanliness, the perfection of their heating and ventilating contrivances, and the presence of everything which can make a car convenient to live in. There is nothing like them in Europe, and all European travelers in this country have been surprised and delighted with them. The Pullman company is successful, as it deserves to be. It now runs cars on nearly one hundred roads, the railroad companies generally owning one half the stock of the cars they use, and thus having a mutual interest. The Pullman company sells to the public what the railroad company in such cases does not furnish—the sleeping car accommodations. You may now ride in Pullman cars over sixty thousand miles of railroad. The Pullman company already employs over two thousand persons, and in its new car shops will employ one thousand more; and all this vast business has grown from the smallest beginnings.

"One of the pleasantest ways to travel across the continent, though not, I think, the way in which you will see most of the people, is to make the journey with a party of friends numerous enough to fill or nearly fill, a car. To show you at what cost—exclusive of the regular railroad fare—such a company may journey, I give you here some extracts from a little book issued, for the information of travelers, by the company:

"For a regular sleeping car, containing twelve open sections of two double berths each, and two state rooms of two double berths each, (in all twenty-eight berths,) with conductor and porter, seventy-five dollars per day.

"For a drawing room car, containing two drawing rooms having each a sofa and two large easy chairs by day, and making up at night into two double and two single berths, three state rooms having each two double berths, and six open sections of two double berths each, (in all twenty-six berths) with conductor and porter, seventy-five dollars per day.

"For a hotel car, containing two drawing rooms, as above described, one state room, having two double berths, and six open sections of two double berths each, (in all twenty-two berths,) and having also, in one end, a kitchen fully equipped with everything necessary for cooking and serving meals, with conductor, cook, and two waiters, eighty-five dollars per day.

"The Pullman hotel car is one of the most ingenious, as well as the most convenient, of modern arrangements for travel. It can seat forty persons at the tables; it contains not only a kitchen—which is a marvel of compactness, having a sink, with hot and cold water faucets, and every 'modern convenience'—but a wine closet, a china closet, a linen closet, and provision lockers so spacious as to contain supplies for thirty people all the way from Chicago to the Pacific, if necessary; its commissary list contains, as I ascertained by actual count, 133 different articles of food; it carries 1,000 napkins, 150 table cloths, 300 hand towels, and 30 or 40 roller towels, besides sheets, pillow cases, etc., etc. And unless you are of an investigating turn, you would never know that the car contained even a kitchen.

"Whenever a sleeping car arrives at the end of a journey, it is laid over for twenty-four hours. Thereupon the porter gathers up the soiled linen for the laundry, and a force of men and women enter the car and take out of it bedding, carpets, and every movable thing; all are beaten with rods and hung up to air; and meantime the whole car is aired, and the woodwork dusted, rubbed, and scrubbed in the most thorough manner. This is the manner of their housekeeping."

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in the month of April, 1872:

During the month, 823 visits of inspection were made, and 1,652 boilers examined—1,605 externally, and 563 internally—198 were tested by hydraulic pressure. Most of these latter were new boilers, in the yards of boiler makers, which we were called to examine previously to their being put in use. Number of defects in all discovered, 1,264, of which 286 were regarded as dangerous. Many of these boilers were in iron works, furnaces, and rolling mills, and were operated by the waste heat, which is often very severe in its effects on boilers. Furnaces out of shape, 51—3 dangerous; fractures in all, 164—65 dangerous. These cases were found mostly in boilers that had been used for some years and overworked, or in those which had accumulated quantities of deposit, and which were badly scaled. Burned plates, 82—29 dangerous; blistered plates, 137—21 dangerous; cases of sediment and deposit, 166—28 dangerous; cases of incrustation and scale, 200—27 dangerous; cases of external corrosion, 79—25 dangerous; cases of internal corrosion, 36—5 dangerous. Internal corrosion is usually the result of impure feed water. Water in and about chemical works is very bad indeed, and such boilers should be fed from streams or pools having no connection whatever with the works. We have of late been obliged to condemn the boilers of a large manufactory of this kind, because, upon examination, they were found in a very dangerously corroded condition. When the feed water for boilers cannot be obtained from sources that are pure, that is, free from acids, carbonate of soda has been found beneficial, and is used quite extensively in England. Cases of internal grooving, 47—10 dangerous; water gages out of order, 40—6 dangerous; blow out apparatus defective, 30—5 dangerous. One great trouble with this last fitting is that it is often partly imbedded in brickwork; the valves and connections are poor or defective, and the result is they leak, and the water in the boiler is found to be low, when the real cause is not understood. Hence the pipes which connect blow out cocks to the boilers should be easily accessible, and in no case should they be imbedded in masonry. Safety valves overloaded and defective, 31—23 dangerous; boilers without gages, 10—7 dangerous; pressure gages defective, 76—17 dangerous, varying from —10 to +7. Cases of deficiency of water, 7—2 dangerous; broken braces and stays, 44—15 dangerous; boilers condemned, 13.

Artists with Bad Eyes.

Rarely, perhaps never, has the skill of the surgeon been demonstrated in such an interesting manner as in the recent artistic researches of Mr. Liebreich. This eminent ophthalmist has lately been lecturing at the Royal and London Institutions on the effect of certain faults of vision on painting, with especial reference to the works of Turner and Mulready. His lectures have excited much interest, especially among artists and art patrons. And his lucid, carefully elaborated demonstrations, which he enforces with almost mathematical precision, lead the great majority of his hearers to the conclusions which he has formed. Mr. Liebreich truly says that many connoisseurs elevate the faults in Turner's paintings into peculiarities of style, and some would even go so far as to form a school to imitate that style. Turner's earlier paintings were not disfigured with the haziness and falsity of proportion which marked his later productions; and these faults the lecturer exactly reproduced to his audience by throwing a landscape or a tree on the screen, and then by interrupting the rays between the picture and the reflection by a lens so constructed as to diverge them to such extent as, according to this theory, they were diverged in the case of Turner. Turner's defect of vision was what is known as "astigmatism," that is, the vertical rays and the horizontal rays of light were not brought to his sight at exactly the same focus. Hence arose the vagueness and incorrect proportions we have referred to. Turner painted from Nature exactly as Nature appeared to him, but not as it appeared to him when his sight was truthful. Mulready's defect was a yellowness in the crystaline lens of the eye, which came on with age, and which occasioned a comparative failure of perception of blue colors. The result was that the artist added his blue tints much too extravagantly, and presented ploughboys in smock frocks as though they had been clothed in purple. Mr. Liebreich's opinions are endorsed by many of the ablest scientific and artistic authorities, and, as we said, seem to be conclusively established by his arguments.—*Chemist and Druggist.*

Expeditions to the North Pole.

According to advices from Stockholm, the projected north polar expedition, under the control of Professor Nordenskiold, is almost ready for sea, and Swedish geographers entertain great hopes of success for the new undertaking. The expedition will have on board, besides Professor Nordenskiold, Lieutenant Palander, of the Swedish navy, who has already had some experience in polar exploration, having accompanied the Swedish expedition of 1868; also a physician, a physicist, and several other servants, who will accompany the expedition for the summer, returning from Spitzbergen in the autumn; making in all, with the crew, twenty persons. The principal object of the expedition, which is not expected to return before the summer or autumn of 1873, is to reach the pole from high latitudes by means of sleighs drawn by reindeer—an enterprise in which the German geographer, Dr. Petermann, of Gotha, does not place much faith. The expedition will take with it from Gothenburg a portable house, of nine rooms and kitchen, which is to be put up on the Seven Islands, in 80° 38′ northern latitude—the most northern point at which an expedition has ever wintered in these regions. Great importance appears to be attached by Professor Nordenskiold to the cargo of fifty reindeer, which he will ship from Norway, together with the necessary fodder and a number of Lapps to attend them.

Dr. Petermann and the great majority of the German geographical societies have given their entire support to the new Austrian expedition, which is to sail from Bremerhaven about the end of June, and which Dr. Petermann greets as "the greatest event in the history of modern arctic explorations." The object of the Austrian expedition will be the farther navigation of the ice-free ocean which they met with last summer to the east and north, and the exploration of the arctic ocean to the north of Siberia. The plan of the voyage is as follows: The expedition being provisioned for a period of three years, the first winter is to be spent on Cape Tschelinskin, the most northern promontory of Asia; during the second summer the exploration of the central polar ocean is to be continued, and an effort made to reach the pole; the second winter will be spent on the new Siberian island, and the third summer will be employed in reaching Behring's Straits and an Asiatic or American haven. The Austrian expeditionary vessel is a three masted schooner, 118 feet long, 25½ broad, 13½ deep, provided with an effective engine of 95 horse power, and coals for forty days.

A TABLESPOONFUL of quicksilver was lately found in an old grave in York county, Pennsylvania. It is supposed to have been buried there in the shape of calomel within the patient.—*Exch.*—[In old times, the doctors sometimes administered pure mercury as a medicine; a more common form of mercurial administration was the blue mass. Either of these prescriptions would account for the presence of quicksilver; but dosing with calomel would not.—EDS.]

BY a single blast of nitro glycerin, at the Hoosac tunnel, North Adams, Mass., the rock was blown out in the center of heading to a depth of eight feet ten inches.

Nature of the Action in Galvanic Batteries.

Professor G. W. Hough, Director of the Dudley Observatory at Albany, N. Y., has made a series of experiments on galvanic batteries, extending over several months, for the purpose of investigating the cause of the decline in the strength of the electric current after the battery has been in operation a long period. It is well known that, since the invention of the American method of recording transits, the galvanic battery has become one of the necessary instruments in every first class observatory. The application of electricity also to the registration of meteorological phenomena makes it desirable to secure the best form of battery, as well as to be able to know what is the difficulty when the battery begins to fail in its work. Some of the leading conclusions reached by Professor Hough were as follows:

1st. In the sulphate of copper battery (Daniell's form) the principal cause of decline in the strength of the electric current is due to the formation of sulphate of zinc.

2d. The quantity of electricity flowing in the external circuit depends upon the specific gravity of the sulphate of zinc.

3d. When the sulphate of zinc approaches saturation, polarization takes place in the battery itself; and, although the electromotive force remains the same, the internal resistance may be increased more than a hundred times.

4th. The sulphate of zinc (or any fluid about the zinc) is only useful as a conductor of electricity.

5th. The copper, or negative metal, is useful only as a conductor, since it may be replaced by any other metal, even zinc itself.

6th. The internal resistance of the battery has been separated into two parts, namely, that due to the porous cell and that due to the liquids employed. The specific resistance of the liquid was found to be 13; that for a small clay cell, 17, and for a leather cell, 7. Since the resistance of the leather cell is less than one half that of a clay cell, it has been used in the construction of batteries at the observatory, as the quantity of electricity is nearly doubled without any increase of surface. For the negative metal, in place of the copper hitherto employed, we have used sheet lead.

These investigations have rendered it possible to compute, with great precision, the length of time a battery will generate its normal quantity of electricity, provided the amount of electricity flowing in the external circuit is known, and the capacity of the vessel holding the sulphate of zinc is determined. The specific gravity of the sulphate of zinc should not be less than 15° or more than 38° degrees of Baumé.

A new mechanism for the more thorough investigation of galvanic batteries has been devised by Professor Hough, but not yet constructed, by which the quantity of electricity flowing in the external circuit will be recorded in the form of a curve so long as the battery is in action. This subject is one of great interest and importance, and it is proposed by Professor Hough to continue his investigation as circumstances may permit.

Swiss School of Milk Production and Management.

The Swiss Mountain Union, which has for many years been interested in the milk business, has issued a circular in which it claims that milk production and the care of the mountain pastures are the inseparable factors of the nation's wealth. The only article of export is cheese, which was exported in 1868 to the value of 18,674,832 francs, and in 1869, to 21,453,796 francs. The increase of milk products in other parts of the world is alluded to. American factory cheese, an imitation of the English Cheshire, is rivaling its prototype in its home market. Sweden and Denmark have established extensive dairies, while Holland, which controls the cheese trade of the world, has established at Utrecht a perpetual exhibition of dairy utensils, etc., for the instruction of dairymen. The Austrian minister of Agriculture has given two annual prizes for the benefit of cheese factory associations, while in Vorarlburg, Tyrol, Bavaria, Italy, and Prussia, the latest facts, principles, and improvements are disseminated by means of itinerant lecturers, fairs, exhibitions, and publications. It is proposed in Switzerland to adopt this policy in the organization of a school of theoretical and practical instruction in milk production and management. For this purpose, funds are to be raised from the cantons, agricultural societies, and individuals. Great results are anticipated from this enterprise.

Mesquite Gum.

Mr. F. Kalteyer, treasurer of the Agricultural and Industrial Association of Western Texas, says the mesquite gum of that region is almost identical with gum arabic, having been in use there for medicinal and technical purposes, especially in the preparation of mucilage, gum drops, jujube paste, etc. The past year it has become an article of export, some 12,000 pounds having been gathered in Bexar county, and as much more between that and the coast. No gum is gathered west of Bexar, though the drought was favorable to a large crop. This gum is hardly known east of the Brazos. It exudes from the stem and branches of a *mimosa*, several species of which grow in Texas, New Mexico, and Arizona. One of these species, *Algarobia glandulosa* (Torrey and Gray, N. A. F., 399), is rarely met with below the mountain region of western Texas. The species most common in Bexar county grows from twenty to forty feet high and eighteen inches thick. From it, charcoal is manufactured. It is generally used for picket poles, being very durable. It is also made into handsome furniture, the grain being very fine. It grows where no other fruit tree would live. It was favorably noticed in the last annual report of the American Pharmaceutical Association.

The Air We Breathe.

Dr. Angus Smith has gathered together and published the results of his investigations into air and rain, and those of the experiments made to determine their relative purity or impurity in various parts of the British Isles and on the Continent.

Numerous observers have experimented on the air and calculated the amount of oxygen it contains, and although formerly results differed, owing probably to defects in the *modus operandi*, latterly the analyses have come much nearer to agreement and minute accuracy. Gay Lussac and Humboldt gave the mean as 21·0 volumes per cent of oxygen. Cavendish, by making a series of 500 analyses, arrived at the conclusion that 20·833 was the mean amount, and later experiments have shown that he was not far out, Graham and Liebig both giving 20·9. Dr. Angus Smith found, from repeated analyses, the following percentage, which we extract from his table as characteristic situations:—

On the N. E. shore and heaths of Scotland	20·999
Outer circle of Manchester (not raining)	20·947
Open places, London, summer	20·950
In a sitting room, which felt close, but not excessively	20·890
In a small room with petroleum lamp	20·840
Theatre gallery, 10·30 p. m.	20·860
Theatre pit, 11·30 p. m.	20·740
Backs of houses, and about closets	20·700
Court of Queen's Bench	20·650
Under shafts of metal mines (average of many)	20·424
When candles go out	18·500
Worst specimen found in a mine	18·270
Difficult to remain in	17·20

The cursory reader who does not stop to examine what these figures really mean will probably exclaim: What difference capable of affecting health can there be in the air of London and that of Scotland—20·999 against 20·950 per cent of oxygen? It is quite true that a mere deficiency of oxygen to the extent of 49-1,000ths may affect us but little, but that deficiency means something more than a mere absence to that extent of oxygen; it involves a question as to what has taken its place. Even so slight a difference as that between 20·999 and 20·980 is equal to 190 in a million, and if we put impurity into water at this rate, it amounts to 13·3 grains in a gallon. This amount, says Dr. Smith, would be considered enormous if it consisted of putrefying matter, or any organic matter usually found in waters. But we drink only a comparatively small quantity of water, and the whole 13 grains would not be swallowed in a day, whereas we take into our lungs from 1,000 to 2,000 gallons of air daily. We must remember, too, that the blood receives the air and such impurities as are not filtered out in its passage, whereas the stomach has powers of disinfection and destruction which render harmless many organic impurities contained in water. But if we take the air found in the pit of the theater, we find that the difference amounts to 2,590 in a million, and the importance of the minute analysis becomes evident.

In the course of his experiments, Dr. Smith constructed a leaden chamber in which the experimenter could shut himself up from the external air. This chamber contained 170 cubic feet of air when furnished with a table and chair, and occupied by one person. On a day when the temperature was 45°F. no difference in the air breathed was perceptible for 25 minutes; but when drawn from the top by moving an umbrella up and down, it seemed like a soft wind capable of producing a slightly pleasant feeling, being, however, utterly without the property of producing that cheering and exhilarating effect to which we are accustomed in a gentle breeze. The air was moist, and a specimen of it deposited water. After an hour, the well known organic smell noticed in a crowded school room was perceptible on moving about rapidly, and at the end of the experiment, which lasted 100 minutes, had an unpleasant flavor and strength, and persons who entered immediately the door was opened pronounced it very bad. Still, Dr. Smith says he did not feel uncomfortable, although the percentage of oxygen must have been reduced below the average found in the ordinary circumstances of daily life, showing the seductive and insidious character of breathed air. After a stay of 2 hours 20 minutes in the chamber, however, long inspirations became more frequent, and the air was found much less agreeable when breathed at the upper part by standing on a chair; at the end of three hours, the amount of oxygen was reduced to 19·61. In an experiment with burning candles, it was found that the amount of light was sensibly diminished, and when the candles went out, the percentage of oxygen was found to be 18·80*, and of carbonic acid 2·28. On entering the chamber with candles and a spirit lamp, the lights were speedily extinguished, and it was found impossible to rekindle them with matches, the ordinary wooden ones refusing to ignite. Still, it was possible to breathe without difficulty, although a feeling of discomfort was soon experienced. Afterwards gas was lit and burnt brilliantly; but on entering with candles after the gas had gone out, they were instantly extinguished. Nevertheless, it was still possible to breathe, although when Dr. Smith stood on a chair, he experienced a feeling similar to incipient faintness; "but the senses were not annoyed by anything beyond a feeling of closeness, by no means so unpleasant as a school room." This is an important fact, as Dr. Smith says, showing almost conclusively that organic matter is the cause of the unpleasantness to the senses on entering a school room; for there was comparatively little organic matter in the chamber, and the school room would have more oxygen than the chamber, the percentage found in the latter, after allowing the door to open for three persons to enter, being found to be only 17·45. The conclusion to be drawn from these experiments, therefore, is that the senses are bad and inefficient guides to the wholesomeness of air as regards the amount of oxygen and carbonic acid, save when the former is reduced and the latter increased to such an extent that the lungs seem to refuse to expand and the whole vital action is threatened with paralysis. Rooms, badly ventilated, which contain less than 20·7 per cent of oxygen are very unwholesome, and the necessity of taking into consideration the proportion of oxygen and carbonic acid in the sanitary inspection of factories and workshops is abundantly evident from the results obtained by Dr. Smith.

*Candles placed in a tin box over water, however, were found to burn till the oxygen was reduced to about 15·5 per cent: but in the lead chamber the candle is extinguished by the tallow refusing to melt. For this reason, miners incline their candles so that the flame may melt the grease.

Gathering Nicaragua Caoutchouc.

According to Paul Levy, the harvester of caoutchouc in Nicaragua goes to the middle of the forest to look for caoutchouc trees (*castillos elastica?*), and when he has found one, he climbs to the top of the tree by the aid of a *gaucho* (a kind of hook) and by means of his gouge makes some zigzag incisions on the principal branches, communicating with each other, to form a kind of general gutter as far as the trunk. The gashes, which go through the bark, are only made on the under side of the branches, but on the trunk they are made all the way to the foot. Some trees give twenty pounds of caoutchouc; the liquid is received in calabashes, where it is coagulated by simply agitating and leaving to itself. To aid in coagulating, the natives use the stalks of certain branchy plants, which allow their sap to flow down and act as a coagulating agent. Caoutchouc of good quality cannot be obtained from trees less than fourteen years old. Unfortunately, the harvesting is done with little care, and the gashes almost always penetrate beneath the bark. A slightly larger yield is obtained, but it is destructive to the tree.

Preservation of Grain in Vacuo.

M. Louvel has brought before the French Academy a plan of storing wheat in portable sheet iron granaries, in which a vacuum is maintained equal to at least from three to four inches of mercury, this being found sufficient to destroy all insect life (although a more perfect vacuum is preferred) and to insure the evaporation of any moisture in the grain. The apparatus is of cylindrical form, placed vertically, and with convex top and bottom. The top is provided with an opening through which the inlet of the grain is had, with a valved pipe through which the air is exhausted, and with a gage by which the degree of exhaustion is indicated. The grain is removed through an opening (provided with a suitable closing device) in the bottom. The pump, which can be used for any number of the grain receivers, costs about one hundred and eighty dollars extra. In one experiment, where living insects were introduced in large quantities with the grain, it was found that they were all killed before doing mischief, and at the end of six months the wheat was found to be in as fine condition as at the outset.

M. LOUIS LA BRECHE VIGER, of Montreal, has obtained a patent for a new method of manufacturing axes, hammers, and other implements, by first making them of wrought iron and then converting them into steel. The articles to be treated are immersed in a bath of molten cast iron free from sulphur and phosphorus, and carburized to its utmost capacity. The best for that purpose is spiegeleisen, but such cast iron may be made by melting good malleable iron or blister steel in a cupola furnace. The articles are left in this bath a space of time which must vary, with the degree of hardness desired to be imparted to the metal and with the size of the articles, and also according to the intention of converting the whole mass of the metal into steel, or simply of converting the surface so as to contain a core of malleable iron.

A FEARFUL boiler explosion recently took place at Manchester, England. Five boilers, each 34 feet long and 5½ feet in diameter, were arranged side by side, each connected by a stand pipe with one horizontal steam pipe. Five safety valves were arranged on the horizontal pipe, one directly over each stand pipe; but no safety valves were directly on the boilers. During the repairing of one of the boilers, a workman had plugged up the stand pipe by which that boiler was connected with the horizontal steam pipe, and had neglected to remove the plug at the conclusion of the job. The consequence was that, when steam was raised, a terrible explosion took place, by which several lives were lost and much property destroyed.

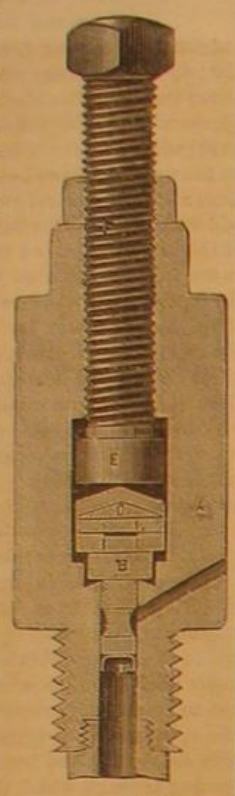
USE OF SEWER WATER AS A MANURE.—According to the *Revue Horticole*, experiments with the sewer water of Paris, in the cultivation of certain lands below the level of the city, commenced three years ago, have been of the most satisfactory character: and the eagerness that the farmers now exhibit to obtain permission to use these waters on their lands, wherever it is practicable, is justified by the great increase in their value, many of them having previously been of little worth. Thus certain lands now rent for six and seven times as much per annum as formerly.

IT is curious how toothache gradually abates as you get nearer and nearer to the dentist's door. It seems almost as if your tooth were an intelligent being which turned coward when threatened, as bullies generally do. In such a case, the tooth has been made to understand that it was menaced, and has been frightened by a process of telegraphy between the mental and physical nerves.

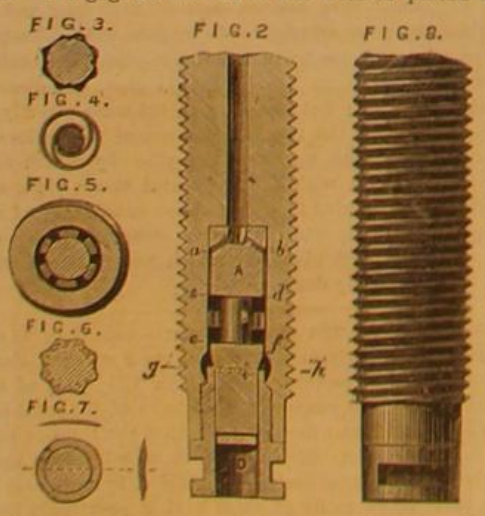
THE interior of the Hoosac Tunnel has lately been photographed by the aid of magnesium lights, while the drilling machines were at work.

GUNPOWDER PRESSURE GAGES.

Amongst the various investigations, to which the great increase in the dimensions of modern artillery has led, is that relating to the pressure exerted within the bore of the gun by the ignition of the powder charge. The object with which the experiments in this direction were instituted was to determine the kind and quantity of the powder best suited for heavy guns. The Committee on Explosions, having the arrangement of the experiments, used the Rodman pressure gage in the first instance. This gage, we need hardly say, comes to us from the United States, having been devised by Major Rodman, the designer of the cast iron gun bearing his name. This gage is shown at Fig. 1, and in using it a hole is drilled through the gun at any point in the bore where it is desired to ascertain the pressure exerted by the exploding charge. Into this hole the tube, A, is screwed, its lower end, which is open, being flush with the bore. The other end is closed with the piston, B, the joint being rendered tight by means of the gas check, C. The piston carries a knife, D, and upon the knife rests a piece of copper, E, which is held tightly against it by the screw F. When the charge is ignited, the pressure of the gases on the base of the piston forces the knife into the copper, and the indent produced is held to be the measure of the pressure which has acted upon the base of the piston.



The results, however, which were obtained with this apparatus were so exceedingly variable that the committee were led to devise a modified form of pressure gage in which some of the causes of error inherent in the Rodman gage were eliminated. The crusher gage, as it is termed, is shown at Figs. 2 and 8, our illustrations having been prepared from drawings with which we have been favored by the War Department. This apparatus was made in the Royal Gun Factories, and consists of a screw plug of steel provided with a movable base, Fig. 3, which admits of the insertion of a small cylinder or pellet of copper, B, in the chamber, *c, d, e, f*. One end of this cylinder rests against an anvil, A, the other being acted upon by a movable piston, C, which is kept well up to the cylinder by means of a small spring, *i*. The copper cylinder is retained in a truly central position within the chamber by means of a small watch spring seen at Fig. 5. In order to prevent any possible leakage of gas into the chamber, the head of the piston is fluted, as seen at Fig. 7, as is also the body of the anvil, Fig. 4. Four small holes, *a, b*, Fig. 3, communicate with a main vent passing through the upper portion of the plug. Against the lower extremity of the piston a gas check, D, is inserted. The crusher gage is used in exactly the same way as the Rodman gage, being inserted at any required point in the bore of the gun. In the eight inch experimental gun the pressures are taken at intervals along the whole length of the bore, holes being drilled for that purpose. As the gases expand, following up the flight of the projectile, the pressures become weaker, the reduction gradually increasing towards the muzzle as the expansion increases. The forward gages are therefore provided with cylinders made from a softer metal than those used at the immediate point of explosion. In the thirty-five tun gun, the pressures are taken at three points, at the end of the bore, at the vent, and at the base of the projectile. The gage for the end of the bore is placed in the



center of a shallow copper pan which is inserted at the muzzle of the gun and carefully pushed down the bore by means of a detachable rod, the same implement being used to withdraw it after a charge has been fired. The vent gage is inserted in the vent hole, while that for the projectile is placed in a hole made in the base to receive it. The gun is fired by electricity, the wires being inserted in the powder charge before it is placed in the gun. To prevent jamming, they are laid along a groove cast on the outside of the projectile, both powder and shot being rammed carefully home together. The action of the apparatus is very simple. Upon the explosion of a charge, the gas acts on the area of the piston and crushes the copper cylinder against the anvil. The amount of compression which the copper thus sustains becomes an indication of the pressure exerted upon the piston. The area of the copper cylinder found most suitable for the eight inch gun is one twelfth of an inch, the piston area being just double, or one sixth of an inch. In order to obtain data whereon to base the calculations of the pressures, a series of experiments were made, by means of a testing machine, to determine the pressure required to produce a definite amount of compression in copper cylinders, similar to those used in the instrument. The results of these experiments were tabulated, and they furnish a means of comparison whereby the amount of compression produced in the crusher becomes a direct indication of the pressure exerted by the gases at that part of the bore or chamber where the gage is placed.

The results of experiments show that, in the case of R. L. G. (rifle large grain) powder, the indicated pressure was from 22½ tuns to 40 tuns per square inch.

During the year 1870, the Russian Government instituted a series of experiments in this direction with 6, 8, 9, and 11 inch breech loading rifles, and 15 inch muzzle loading smooth bore guns. The object of the experiments was to ascertain the comparative action of grain and prismatic powders in heavy charges, and also to determine the charge suitable for each class of guns. The pressures varied with the charges and projectiles, from 11 tuns to 18 tuns per square inch.

These experiments led to the decided preference of prismatic as against grained powder. With equal velocities, the grained powder developed more than twice the pressure obtained with the prismatic powder. This wide difference, however, was only developed when the velocities were very high; and the higher these ranged, the greater the difference of pressure became between the two powders—always showing in favor of the prismatic. The experiments also indicated the great importance of the size of the diameter of the cartridge in muzzle loading guns, and of the length of the powder chamber in breech loaders. For instance, in the 15 inch gun, the velocities were equal with charges of 75 pounds and 100 pounds, when the diameter of the first was 12 inches, and that of the last 9·7 inch.—*Engineering*.

ON ICE, WATER, VAPOR, AND AIR.

[Report of a recent lecture by Professor John Tyndall, before the Royal Institution.]

Attention was first directed to a large tub in front of the lecture table, containing a freezing mixture of pounded ice and salt, in which were embedded some iron bottles with plugs screwed into their necks, and a large bomb shell, all of which were completely filled with water. Water, when frozen, expands, and these vessels being completely full, it can only do so in their case by rupturing the iron envelope which incloses it, which the speaker hoped would be the case during the following hour.

The great body of the light rays from the sun, and even a portion of the dark ones, pass through ice without losing any of their heating power, and when properly concentrated on combustible bodies, their burning power becomes manifest even after passing through the ice. In an experiment made by Dr. Scoresby, in the polar regions, he succeeded in so concentrating the sun's rays by an ice lens, as to make them burn wood, fire gunpowder, and melt lead; thus showing that the rays of the thing we call radiant heat retain their power even after they have passed through so cold a substance.

Yesterday we succeeded in making a very beautiful ice lens with which we burnt paper, ignited matches, lighted cigars, and exploded gunpowder by the light or by the heat rays—for they are synonymous. I may add, that Mr. Faraday, in summer weather, has been fortunate enough to get a sunbeam through an aperture into this room, and after passing it through an ice lens, to explode gunpowder.

I take this slice from a block of ice and place it in this hot mold, and in a few minutes, as you see, we get it beautifully convex. The lens thus made was held in front of the electric lamp so as to include the whole beam, and a cone of light having its apex a few feet from the lamp was very visible; black paper and matches were ignited almost instantaneously when held at the point, and gunpowder was also exploded; thus verifying and repeating with the electric lamp Scoresby's experiments with the solar rays. We have all these wonderful effects produced by heat which has passed through so cold a body as ice.

I want you to take notice of the small still which is at the corner of the table. The small boiler contains water which is now getting hot, but as yet no steam has been formed; the water surrounding the worm is ice cold, and the glass vessel which will collect the distilled water is now quite empty. In a little while I shall revert to this again.

Now let us mark the wonderful power of ice to mold itself to the valley through which it passes, as exhibited in the glaciers of Switzerland, where the ice can accommodate itself to the flexures of the valley, and the immense masses of ice, which are the tributaries of the Mer de Glace (the Cascade du Taléfre, the Glacier du Géant, the Glacier de Léchaud, and the Glacier des Périades), weld together and squeeze themselves into the extraordinary small space we find at the gorge of Trélaporte. Is not this a wonderful proof of the yielding power of ice?

Now I want to make plain to you the possibility of a substance like ice, being squeezed in this way, changing its form but not its volume, and appearing after that change as solid and homogeneous as before. Below the freezing temperature ice is a very hard, brittle substance, but above the freezing point it is much softer and more yielding; it can be readily cut with a knife. But there is something more to be observed; ice not only can be cut with ease when it is melting, but it reunites as readily. This curious phenomenon was first observed by Mr. Faraday who found that, when two pieces of ice with moistened surfaces were placed in contact, they became cemented together by the freezing of the film of water between them, while, when the ice was below 32° Fah. and therefore dry, no effect of the kind could be produced. The freezing was also found to take place under water, and, indeed, it occurs even when the water in which the ice is plunged is as hot as the hand can bear.

Dr. Tyndall then repeated Faraday's experiment. A slice was sawn off a large mass of ice, and then laid on the place from whence it had been cut; a few moments rendered the junction as complete to all appearance as the rest of the block, and the large mass was lifted from the table by the re-united slice. Two smaller pieces of ice were then held closely together in a vessel of warm water, the result being the same as before—one mass of ice in place of two.

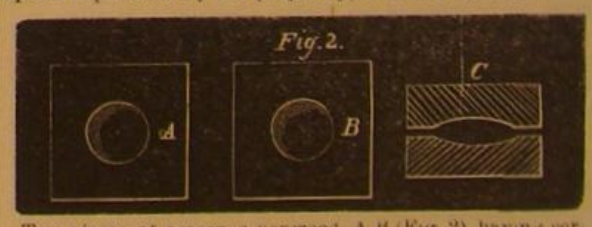
It is one of the most valuable features of the science we are studying, that it encourages thinking over facts; by reflecting on these facts, many additions have been made to our knowledge of glaciers and icebergs. This phenomenon is known as regelation. Icebergs are sometimes formed in the open sea by the linking together in this way of separate pieces of ice, and still more frequently icebergs coalesce and form huge chains and islands of ice in mid ocean by the refreezing of the contact surfaces of melting ice.

Generalization from these interesting facts led Dr. Tyndall to conclude that a bruised mass of ice, if closely confined, must re-cement itself when its particles are brought into contact by pressure; in fact, the whole of the experiments about to be recorded immediately suggested themselves to his mind as natural deductions from the principle established by Faraday.

Professor Bottomley made an experiment recently, which, as it bears upon this subject, I have set going for you. A block of ice (Fig. 1) was placed on two uprights, with a loop of wire round it, to which was attached a twenty-eight pound weight. The wire immediately began to enter the ice and passed right through it, afterwards dropping down with the weight; but the ice remained undivided, and except for a little opacity along the plane of passage, showed no signs of ever having been divided.

Now let us ask ourselves what must become of the snow granules when they are squeezed together? Every boy knows that they cohere and form a snowball. Salt will not act so. I have no snow, but I can find a substitute for it. Snow is frozen water, and so is ice; if I scrape down this ice into a powder, we shall find it a very good substitute. This was done, and in order to make the snowball firm, the first rough mass was put in a boxwood mold and squeezed in the shape of a sphere, by a hydraulic press. The operation was then repeated, the mold being opened and more ice powder, or rather ice slush, being added, each time, until at length a beautiful solid ball of clear ice was obtained, which, from its containing scarcely any air in its interstices, was rolled before the boys as the firmest snowball they had ever seen.

Dr. Tyndall then made a number of experiments proving how readily ice can be molded to any shape. Were the result worth the labor, it would be possible to make vases and statuettes, to bend it into spiral bars, or even to form a knot upon a rope of ice by the proper application of pressure.



Two pieces of seasoned boxwood, A B (Fig. 2), having corresponding cavities hollowed in them, so that when one was placed on the other a lenticular space, C, was inclosed, had a rough sphere of ice scrapings placed between them, and were subjected to the action of a small hydraulic press. The ice crackled a little, and in a few moments a lens of compact ice was taken from the mold. This lens was in its turn placed in the mold. This consists of a block of boxwood having in it a hemispherical cavity, and covered by a second block, upon which a hemispherical protuberance, smaller than the cavity, has been turned; so that when the latter is placed in the former, a space of a quarter of an inch exists between both.

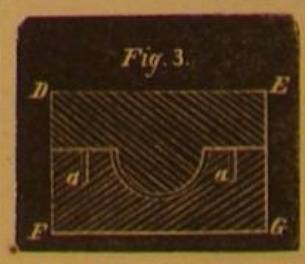


Fig. 3 represents a section of the two pieces of boxwood: the brass pins, *a a*, fixed in the slab, D E, and entering suitable apertures in the mold, F G, being intended to keep the mold concentric. After the ice was subjected to the hydraulic pressure for a few minutes in this mold, it was taken out as a smooth compact cup, its crushed particles having reunited and established their continuity. The cup was filled with wine to prove the perfect cohesion.

At this point of the lecture, the bomb, before mentioned, in some unexplained way exploded; it did not, as was expected, burst, but shot out the screw plug with great violence up into the gallery of the theater; the iron bottles were ruptured with very little noise, but were split from end to end, thus impressing the fact very forcibly on the young

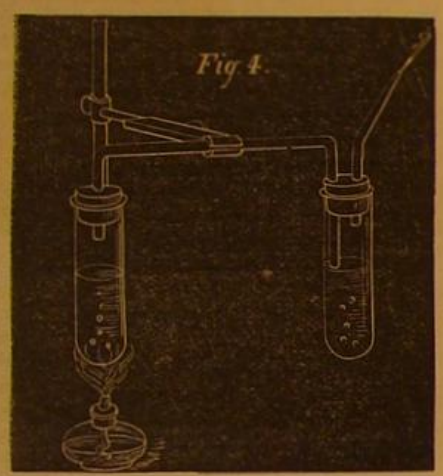
-hearers, that when ice freezes it is larger than the water from whence it comes, and that it cannot freeze without undergoing this change of bulk, which will burst almost anything.

Two cups were next made in the mold above described, and a piece of sealing wax being placed in one, the other was brought down upon it, so that their pieces met, when a momentary squeeze with the lecturer's hand joined them together into a hollow globe. Rings of ice, which had been molded before the lecture, were joined to form a chain; indeed, there is scarcely any limit to these experiments, if time would permit.

The effect of subjecting ice to strain and pressure, when below the melting point, was next demonstrated. This was done by crushing chilled ice in an iron mold; a series of loud cracks announced the rupture of the ice under these circumstances, and at the end it presented itself as a white powder, looking very much like rough salt.

You can now understand how a substance which so readily changes its form under pressure, and so readily re-unites itself when broken, can be forced through narrow gorges, and can accommodate itself to the bendings of the valley through which it moves. But there was another famous theory, which will lead me to say something about another property of ice. If you melt a quantity of ice, the water produced is not quite so big as the ice, and if you freeze water, the ice produced is somewhat bigger than the water; and as you have just now seen, the water swells in freezing, and the force with which it swells is enormous. It was this force that some eminent men thought to be the power which urged the glaciers continually downwards. But the glacier is not continually converting water into ice, as this theory supposes. This experiment leads me to think that you would like to see water frozen and a little bombshell burst in a red hot vessel. But you must first give me your attention while I explain the process.

Let us look at the still which, at the beginning of the lec-

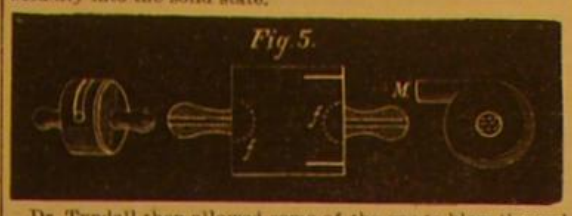


ture, I put in action. You see that in this space of time but a very small quantity of water has distilled; but look at the worm tub, and you see that a large quantity of water which was ice cold at starting has been made itself to steam—by what? By the heat which that small quantity of water contained when it was steam.

You can also boil water in one vessel by the steam generated in another, and thus actually measure the heating power of the steam. Two wide test tubes (Fig. 4), connected by a piece of quill tubing which, starting from the neck of one, goes to the bottom of the other, were about half filled with water; and a spirit lamp, placed under the first, in a short time created sufficient steam to pass into the second tube; but, however familiar the result, it was almost startling to see how very much more rapidly the second was made to boil, by the steam which was passed into it, than that had done which had been heated by the lamp, and also the minute increase in bulk of the liquid.

The rule is quite general that, when a liquid passes to the state of gas, heat is consumed, and if heat be not supplied, intense cold is produced. Ether poured on the hand produces an extreme feeling of coldness from the rapidity with which it evaporates. And the rule is just as general that when a solid is dissolved, heat is consumed and cold produced. This explains the coldness of the mixture of salt and pounded ice, or salt and snow—the salt causes the ice to melt, and thus produces great cold. Salts which dissolve with great rapidity produce a correspondingly great degree of cold. This has been taken advantage of by many persons who have invented different kinds of freezing machines. That which we have here is by Mr. Ash, and the ice which I turn out has been produced by the absorption of heat by liquefying certain saline substances, without the use of snow or ice.

We are now prepared for an experiment. There is a gas, which is a very heavy one, often found in brewers' vats, at the bottom of deep wells, etc., a poisonous gas; accidents happen sometimes by the men, who go into these vats to clean them out, not taking sufficient care to see that this gas is first removed. It extinguishes flame, and has many more remarkmarkable qualities. This gas is carbonic acid; now when this gas is subjected to very great pressure, its particles are squeezed closer and closer together, until at length it becomes a liquid. In doing this, the gas gives off a great quantity of heat, the vessels and the pumps becoming very hot. This you understand from what you saw and were told in the earlier lectures. I have some of this liquid gas in this iron bottle. When the cock is turned on, what takes place? Some of the liquid is immediately turned into gas, and takes up, in so doing, exactly the amount of heat it lost in being converted into liquid carbonic acid; but this is done with exceedingly great rapidity. Where is the heat, that it requires, to come from? All the tubes and vessels through which the liberated gas passes become intensely cold, the air in the immediate neighborhood is robbed of all its moisture which falls as snow, but even the heat from these sources is not enough, and it gets the remainder from itself. The total amount of heat, required for part of the liberated gas, is got at the expense of another part, which loses so much heat that it becomes converted, not into the liquid but actually into the solid state.



Dr. Tyndall then allowed some of the gas to blow through a suitable vessel (Fig. 5) for retaining the solidified gas, and in a few minutes exhibited the carbonic acid snow in considerable quantity.

The recipient for the solid carbonic acid is an ingeniously constructed draw out box, the contrivance of M. Thilorier. It consists of a brass cylindrical case, having tubular handles affixed to its ends. Plates of pierced brass are fixed before the outlet of each handle as shown by *f f*; these act as sieves, to keep back the solid acid and allow the gas to pass out. The box has a short tube joined to the side, as in the sectional drawing, so as to form a tangent to the inner circle of the case, and opposite to this tube is placed a bent piece of brass, in order to prevent the violence of the inrushing gas from blowing the solid matter into such fine particles as would enable it to pass through the perforated disks. For the purpose of taking out the solid, the box is made separable, by one end sliding over the other, and retainable together by two obliquely grooved holders placed on opposite sides of the joint. When being used, the tangent tube fits over the nozzle of the gas bottle.

Following out the rule we laid down, if we liquefy this solid, or dissolve it rapidly, the reduction of temperature is now something beyond what can possibly be borne by living creatures. Faraday proved this temperature to be nearly 140° below the freezing point of water, and he made it lower still, by putting it under the receiver of an air pump and exhausting; the temperature thus obtained was 166° below zero, or 198° below the freezing point of water.

If I hold this test tube with the mixture of ether and carbonic acid in it in the electric beam, you can see, not only the hoar frost upon it brilliantly illuminated, but also that the cold in its neighborhood is sufficient to condense and refrigerate the moisture dissolved in the warm air of this room, and in consequence, a miniature fall of snow is produced.

It is plain that a sufficient degree of cold is produced by this mixture to freeze the water in our little glass bomb as we proposed, but how can this be done in a red hot vessel?

Leidenfrost observed that if a sheet of metal, such as this silver basin, is made very hot, and that then a drop of water is allowed to fall upon its surface, the liquid does not boil, but instead of wetting the surface as usual and fizzing off in steam, it rolls about in a lively way in a spheroidal shaped mass (Fig. 6). The reason of this is that the temperature of the basin is so high that it immediately converts any liquid that touches it into vapor, upon which the liquid rests as on a cushion; in fact, the water is lifted up from contact with the hot metal by a spring of its own vapor; so that you see the possibility, at any rate, of a very hot and a very cold substance being very near together, so near as apparently to be touching each other, and that, nevertheless, the distance between them may be sufficient for each to maintain approximately its own temperature.

A mixture of solid carbonic acid and ether was then placed in a red hot platinum crucible, fixed in a circular hole in a large plate, to avoid firing the ether vapor by the flame of the lamp, and a glass tube, having a bulb filled with water at its end, was used to stir about the freezing mixture; in a few minutes a solid lump of ice was produced as it were from the center of a fiery furnace.

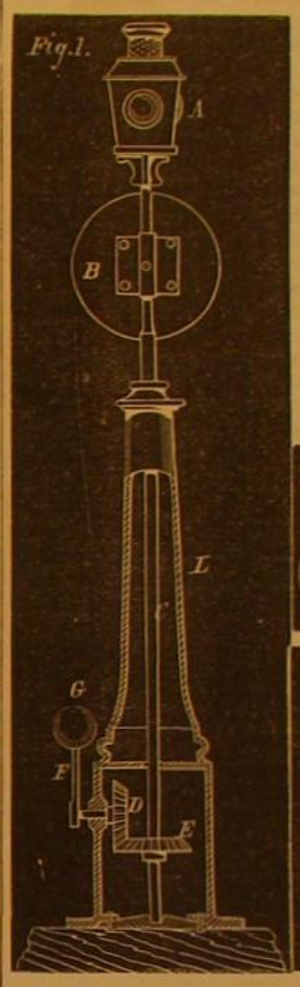
Some of the peculiarities attending cleavage were then touched upon. The little atomic bricks which form crystals often arrange themselves in layers which are perfectly parallel to each other, and which can be separated by mechanical means. Rock salt can thus be cut up into layers, and these layers may again be divided in certain other definite directions. There are, however, other phenomena to which the term cleavage is applied, and in some of these the cleavage only takes place in one direction. Sandstone cleaves in planes parallel to its bedding lines. Among the substances capable of cleavage, slate ranks very high; the blocks in which it is quarried cleave with the utmost facility into thin laminæ, which can be split up again almost indefinitely if the instruments be fine enough. Many theories explaining this peculiarity of slate have been promulgated, but at last it was found that the lamination of the mass was produced by pressure, and that these planes of cleavage were invariably at right angles to the direction of the pressure.

The flattening out of fossils in the slate forms an additional proof of the correctness of the conclusion. Some specimens were exhibited, showing the distortion of trilobites and shells.

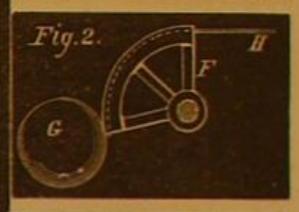
The same cause, which produces the cleavage planes of slate rock, also produces the veined structure of the glaciers. The ice of the higher regions is whitish, through the diffusion of small air bubbles within it. At the sides of the glaciers and at the bottoms of cascades, this ice is sometimes subjected to enormous pressure. It yields laterally as the slate mud has yielded, and a laminated structure is the consequence. On the surface of the glacier, under the medial moraines, and on the sides of the crevasses, the lamination reveals itself as clear blue veins or streaks drawn through the whiter ice.

NEW DEVICE FOR RAILWAY SIGNALS.

Our engraving illustrates a new form of railway signal which is now being introduced along the line of the New York Central and Hudson River Railroad.



In Fig. 1, A—the lamp in which bull's eye lenses of white and red glass are arranged—and B—the target—are attached to the rod, C, which passes through the ornamental iron post, L. The rod is arranged so as to be easily revolved by the action of the miter wheels, D and E. To the wheel, D, by means of a rod passing through the post, the lever, F, is attached, at the end of one arm of which is a solid weight, G. The form and arrangement of the lever and weight are shown in Fig. 2.



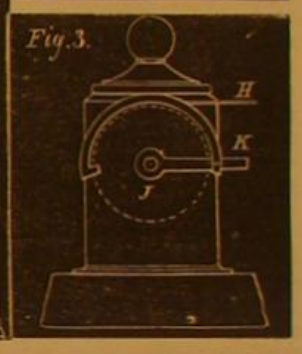


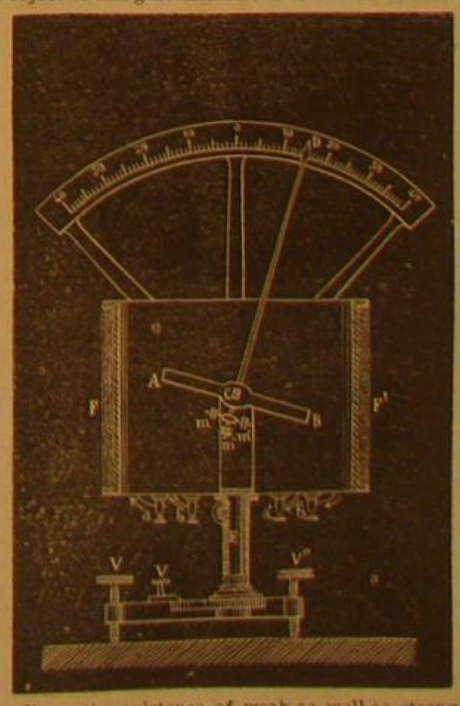
Fig. 3 represents the signal post, on the exterior of which is a hand lever, K, working in a semicircular guide and turning the sheave, J, within the post. To the circumference of this sheave, the wire, H, is fastened, passing therefrom over other sheaves for a distance of from 1,000 to 2,000 feet, until it reaches the lever, described on Fig. 1, to which it is attached, as shown on Fig. 2.

By raising the hand lever, K, the sheave is turned, and the force communicated to the wire raises the lever, F, and weight, G, which, by the action of the miter wheels, revolve the rod, C. By this means, the red or danger side of the target and the red light are displayed. On returning the lever, K, to its former position, the wire is loosened, and the weight, G, falls, turning back the lamp and target.

The apparatus was devised by Mr. J. M. Toucey, the superintendent of the road, and is now in successful operation at many points along the route.

VERTICAL BALANCE GALVANOMETER.

The object of this galvanometer is to render sensible to a large audience the existence of weak as well as strong currents of electricity, without the necessity of employing any



expensive or cumbersome accessories, such as a lantern to project a magnified image of the galvanometer needle and scale on a screen, in order to render the deflections more evident.

The chief part of this apparatus is a balance beam, A B, of magnetised steel poised on knife edges, as in a common weighing balance. At right angles to this beam is fixed a long pointer, D, the point of which can be adjusted at zero by means of two thumb screw weights m, m^1. The sensibility to motion of the beam can be rendered greater or less by screwing up or down the weight m^2.

The magnetized beam is placed in the center of a bobbin ring, F F^1, of dimensions sufficiently large to render the action of the current on the beam practically the same at whatever angle the beam may have turned through. The sensibility of this instrument will be seen when it is mentioned that the current produced by merely bringing the hand near a thermopile will give a very large deflection. The beam of the instrument can be removed and remagnetized with great facility if its polarity by any means becomes destroyed or reversed. It is necessary, in setting up the instrument, to place it in such a position that the vertical plane passing through the beam may cut the magnetic meridian. It is sufficient if the part of this plane which contains the south pole of the beam makes, with the south pole of the dipping needle, a less angle than 90°.—*Mechanic's Magazine.*

Telegraphy without Insulation.

Mr. H. Highton recently read a paper on this subject at the meeting of the Society of Arts in London. He showed by experiment that water itself is for electricity of low tension so perfect an insulator, that a long wire on a plate of copper charged with electricity of low tension will retain the charge even for hours; indeed quite as obstinately as the glass of a Leyden jar retains a charge of high tension. The instrument he proposed to use for submarine telegraphy is a light slip of gold leaf, weighing from one 500th to one 2000th part of a grain, acted on by a powerful electric magnet, and with its motions optically magnified. The delicacy of this is so great that simply looking at a thermopile will transmit a visible signal through the resistance of the Atlantic cable, and a kiss or grasp of the hand a very strong signal. So that a modern Pyramus and Thisbe might exchange salutations not through a hole in the wall, but through the breadth of all the waves of the Atlantic. The use of this instrument gives an opportunity of using electricity of the very lowest tension which, besides its other advantages, has a much less tendency to escape by faults in the wire. It was shown that a fault which caused the disappearance of all visible signals through Thomson's speaking galvanometer, with a resistance of 500 units, or about 125 miles of the Atlantic cable, would still allow intelligible signals to be transmitted on this instrument with 10,000 units, or 2,500 miles of resistance. The other advantages were the absence of all swing, such as there is in a needle, and an instantaneous movement, in spite of electrostatic induction. Where it requires two or three seconds for the wire to accumulate sufficient charge, to overcome the initial friction in any instrument where there is any friction, however slight, it moves at intervals of seconds by jumps, but the gold leaf, having no friction, begins to move instantaneously and proceeds by an equable motion. Again, where increased sensitiveness is required, the only thing necessary is to increase the force of the electro magnet at the receiving end. The conclusion the author drew from his experiments was that, instead of the hundreds of thousands of units of insulation of the present cables, it would be quite feasible to work through a cable having only a single unit of insulation; or if greater insulation were desirable, a wire might be used presenting much more resistance to the currents, such as a steel wire, possessing more strength and cheaper than copper, and that electrostatic induction being less injurious, much cheaper, with less gutta percha, cables might be used costing some fifth or sixth of the present prices, and that thus telegraphy might be made much cheaper and more available for hundreds of thousands of poor emigrants, instead of being the luxury of rich merchants, or speculators, or government officials. £50 a mile ought to provide a wire, sufficient for all purposes, of any required length.

Vitrified Marble.

The material itself results from the admixture, and melting together in a furnace, of equal parts of certain vitreous and silicious substances in about equal proportions, to which are added, at a suitable stage and in the requisite quantities, such coloring materials as will produce the desired effects, either as a plain body color equally diffused throughout the mass, or in veins of one or more colors with or without ground. When in a semi-fluid state, while yet hot, small or large masses of this plastic matter are cut off and pressed into iron or steel molds carefully formed to the desired shape. In this manner decorative objects of any size, shape, or appearance can be produced with the utmost facility and rapidity of execution.

The manner in which natural materials of all kinds can be imitatively reproduced is extraordinary; ordinary marbles, veined and other, porphyry and malachite, jade, lapis lazuli, etc., thus prepared are, if anything, more real than the genuine objects themselves, and have the advantage of being in forms that could only be obtained out of the originals with great labor, waste, and cost. They can also be obtained and applied in bulk and solid masses, as for vases paper weights, inkstands, table tops, etc, or in minuter portions, such as pateræ and tesseræ, or amorphous pieces for mosaic work in every variety, suitable for dados, pavements, etc. For the latter purpose, the vitrified marble paving possesses an important advantage over marble and encaustic tiles, in relation to the surface, which is rougher and more safe and pleasant to tread upon, giving good foothold and equable wear, while lending itself to every pattern, regular or the reverse. And it is not only in respect of mere surface patterns, but also of raised designs and molded forms of every species, that this material is susceptible of adaptation. Indeed, the sharpness of definition and accuracy of detail, of which it admits, are alike noteworthy.

It cannot, moreover, be said of this invention, as of so many others, that the fairness of its promise in conception is marred or belied in practical application. On the contrary, it is sufficient to say that the most eminent architects of the day have given their testimony, in evidence of its merits, by adopting it in leading works, which are alike monuments of their skill and of national objects. Mr. G. Gilbert Scott, for example, has made use of it largely in the bosses and gems for the decorative work of the Royal Albert Memorial in Hyde Park; and nearly 2,000 of these ornaments have been introduced therein, studding and decorating the work with equal brilliancy and effect. Jesse Rust, of 15 Coleman street E. C., London, England, is the patentee of the above material.

Correspondence.

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

Petroleum and Coal.

To the Editor of the Scientific American:

I find, in your paper of May 25th, an article copied from the *Petroleum Monthly*, in which the statement is made that no coal beds, capable of being worked, are to be found within fifty miles of the oil producing territory. This, to the oil men of West Virginia, is indeed a startling assertion, as we obtain all our fuel from the same hills on which the wells are located; and, within the present month, an instance occurred wherein a party engaged in boring struck, as they supposed, a crevice of five feet, and knew no better until a miner came up and informed them that their auger had come through and, barely missing the mule, had disabled their car by falling through it; in another instance, a well, deserted as non-paying prior to the introduction of torpedoes, was leased by other parties; and in attempting to tube it, the hole was found obstructed and a man was sent into the coal bank about 100 feet below; and it was found covered with a pile of slates. In both these cases, the vein was about five feet thick and of a very good quality of bituminous coal. All the wells located on the hills pass through at least one vein of coal, and most of them through two veins; in some cases these amount in all to nine feet in thickness It seems incredible that any one should undertake to write on a subject in which he is so lost as to assert that "in boring for oil, no coal has ever been found even in the smallest quantities." Again, the writer asserts that there is no evidence that petroleum is not derived from bituminous coal by distillation. If such were the case, could we not reasonably expect to find at least a trace of petroleum in the rocks adjacent to the coal? But the facts are that at least one hundred feet of strata intervene before we reach the first rock in the least impregnated with petroleum. Nor do we have any reason to believe that it is derived from the limestone, as we have the best authority that limestone under high pressure does not part with its carbon on being heated, no matter how intense the heat; and we do not find the oil in the limestone, but above it, in the sand rock. He admits, also, that carbon does enter into the composition of petroleum; put does hydrogen, to any extent, enter into the composition of coal or limestone? And if not, whence is derived the hydrogen to constitute the hydrocarbon? He then asserts that "petroleum is certainly a mineral oil," an assertion which the facts do not warrant, as geologists agree that coal is of vegetable origin. Again, as to the reproductive power of wells; if he will take into account the increased experience and facilities, added to the fact that, in all territory where surface water is not allowed to flood the wells, the salt water is becoming exhausted, and oil which was held back is allowed to flow down to the bed rock and reach the wells, also the fact that much of the oil is not in crevices but merely confined in the porous sand rock, and, as the cavities are emptied, it oozes out where it reaches the pump, he can readily account for this "reproductive power." I am not in the habit of catching folks on pin hooks, but when I see an article going the rounds of the scientific papers, so at variance with the plain facts of the case, I feel called upon to refute it, as my idea of science is that it is "truth demonstrated."

As one who has spent years in the oil regions and tried to arrive at the facts, I might say much that would at least have the merit of being scientifically correct, but I defer for the present, being firm in the conviction that enough has not been said to arrive at the "Origin of Petroleum," a knowledge of which would assist, as well in the location as in the working of the wells. G. W. S.

The Rubber Tip Pencil Case.

To the Editor of the Scientific American:

My attention having been called to-day to your editorial on the decision of Judge Benedict in case of the Rubber Tip Pencil Company vs. S. D. Hovey *et al.*, I desire to correct several errors therein contained. First, this case is wrongly reported both in your paper and the Patent Office *Official Gazette*. Judge Benedict declined to hear the above case, and it came before Judge Blatchford in April, who dismissed the bill with costs. The only case heard or decided by Judge Benedict was the case of the Rubber Tip Pencil Company vs. Howard, Sauger & Co., which was materially different from the case against Hovey, as it contained no question of estoppel and was decided nearly two months prior to Judge Blatchford's decision. Your most serious error, however, is in construing Judge Benedict's decision into an opinion that attaching rubber to a pencil for erasing purposes, for convenience, is not patentable; for the learned Judge says nothing which can possibly be construed into such an opinion. Blair did not claim to be the inventor of attaching rubber to pencils for erasing purposes, but only claimed to be the first inventor of a rubber cap or tube (or as Judge Benedict describes it, "a piece of rubber with a hole in it") which could be applied to a pencil. If Blair had contented himself with claiming rubber on a pencil, the result might have been different, but in claiming it broadly, off or on, he claims nipples and every style of rubber with a hole in.

As I fully agree with your views as to the patentability and importance of the invention of combining rubber with a pencil for convenience in erasing, and as I believe Judge Benedict has the same views, I deem it but justice to him to correct these errors, into which almost every casual reader of this decision has fallen. SAMUEL D. HOVEY,

President of Goodyear's Rubber Head Pencil Company, 205 Broadway, New York.

Novel Method of Indicating a Hot Journal.

To the Editor of the Scientific American:

My ingenious and able colleague, Dr. Mayer, has recently been experimenting, during the course of an interesting investigation, upon a number of substances which change color on raising their temperature and regain their original hue when cooled.

Iodide of mercury is one of these substances, and he suggests that if a bearing, to which access is difficult while machinery is in motion, or which, for other reasons, cannot be conveniently reached by the hand and its condition thus known be painted with iodide of mercury or some such material of changeable color, its darkening when the journal heats, may make it a valuable indicator. Its change—from bright red to black at about 70° C.—would attract attention from a considerable distance.

I have sent you this suggestion, as I have no doubt that it may prove very useful to some of the readers of the SCIENTIFIC AMERICAN. R. H. THURSTON.

Stevens' Institute of Technology, Department of Engineering, Hoboken, N. J.

Sea Sickness.

To the Editor of the Scientific American:

In your issue of May 18th, you have an article on sea sickness which attempts to give a philosophical explanation of the phenomenon, namely, pressure of blood upon the brain during the forward pitch of the vessel. Sickness from swinging is referred to the same cause. The proper position to lie on board a pitching vessel is given as being with the head toward the bows, etc. In all the cases referred to, the motion was either rising and falling, or gyrating.

I was a witness and a sufferer in a case of sea sickness, wherein the conditions were so different from all other cases I ever heard of that I thought them worth the consideration of those who wish to account for sea sickness, especially as I could not see how the above explanation could account for this case.

Some time ago, while riding in the cars between Cleveland and Columbus in Ohio, one side of the engine became disabled and all the work fell upon one cylinder. All went well enough till we came to an up grade, when the engine stopped with piston at the dead point. The engineer contrived to start again, but the motion, for every revolution of the drivers, was alternately fast and slow, being almost nothing at the dead point, *crescendo e diminnendo*. In a few minutes I began to feel sick, and as the train did not move faster than I could conveniently walk, I got out and kept along with it. I was soon joined by others who said they were sea sick, and I suppose that half the passengers in the car I was in felt the symptoms of sea sickness, which lasted as long as the irregular motion. Now this motion was straightforward, no pitching, rolling, swinging, or turning, and no position that could be assumed would avail against its unpleasantness. There was nothing about it to determine the blood to the head rather than anywhere else, as far as I see. I submit the case to those whose business it is to explain it. A. E. DOLBEAR.

ANOMALOUS SPECTRA.—A recent number of Poggendorff's *Annalen* contains a short but interesting paper by Christiansen of Copenhagen, in which he states that a hollow prism filled with the alcoholic solution of fuchsin produces a highly anomalous spectrum, which, instead of proceeding regularly from the red to the violet, like the ordinary solar spectrum, stops at a certain point, returns backward, then stops again, and resumes a direct course to the end. Kundt finds that anomalous spectra are given by all the anilin colors, and by permanganate of potash. Such spectra generally turn back upon themselves, having the green at one extremity, the blue being situated between the green and the red.

PUBLIC CLOCK REGULATORS AT PARIS.—In the various squares and public places of Paris, instruments are being put up for the regulation of clocks and time pieces. This little invention of M. Detouche, the well known clockmaker, called the equatorial quadrant, appears to be a complete epitome of practical astronomy, as by it the true mean solar time can readily be determined anywhere, on the spot. M. Detouche has supplied numerous models of his invention, adapted for a variety of situations, and the little instrument is said to be coming into very general use.

CORKS AND CORK CUTTING.

The cork tree is a native of Spain and Portugal, being found in the latter country in large numbers in the vicinity of Lisbon. A recent visit to that capital afforded us an opportunity to inspect the method of obtaining this useful material directly from the trees, and a stroll through some of the cork cutting establishments in this city enables us to trace the progress of the bark from the time it is removed from the forest to its final entry into our American market.

Cork is the soft cellular interior bark found in a peculiar variety of the oak (*quercus suber*). It lies inside of the exterior woody covering, growing from year to year as the diameter of the tree increases. During the first fifteen or twenty years of its existence, the cork contains considerable wood, which impairs its elasticity and renders it unfit for use, so that until the tree has attained the above mentioned age, the material is not fit for the market. After that period, the cork begins to die. Its growth ceases, and the trunk, continuing to increase in diameter, splits it off in layers which are removed every eight or ten years, the quality of the material improving by age. The tree does not suffer from the process, as it generally lives from one to two hundred years.

The cork is removed by first making several longitudinal clefts up and down the trunk, and then girdling the latter by horizontal incisions. The bark is pounded, detaching it from the tree, so that afterwards it is easily removed by the wedge-shaped handle of the axe used for cutting. This labor is done almost entirely by a peculiar tribe of nondescript beings, either Indians or gypsies who, originally inhabiting the mountainous regions in the north of Portugal, seem at present to have abandoned their wild life, as they perform most of the menial work of the country.

The layers of bark as they are removed are first soaked in water and then blackened over a coal fire, the object of this proceeding being to make the surface smooth and at the same time to conceal any flaws in the shape of knots or cracks which may be visible thereon. They are then pressed and finally packed on lighters, for transportation down the Tagus river to the warehouses of Lisbon. These lighters are vessels of peculiar shape, as they are of very broad beam though having a sharp bow.

Thwartships the boat, poles are placed quite close together, on which the layers of cork are heaped to a hight of fifteen or twenty feet, often loading down the lighter until the water reaches her gunwale. The means of propulsion is a three cornered sail, and the crew consists usually of three men, dressed in a highly picturesque costume, who contrive by the aid of long oars to manage their craft, in spite of the strong tide which often renders navigation a matter of difficulty.

After being received at the warehouses, the large sheets are cut into pieces of about three and a half feet in length, eighteen inches in width, and ranging from one half inch to three inches in thickness. Drying and packing in bales weighing one hundred and fifty pounds each follows, and the cork is ready for exportation.

We next find it in the hands of the cork cutter in this country, who pays from five to twenty-five cents a pound for the rough material in the bale. As the latter is unpacked, the slabs are inspected and assorted according to their sizes and quality, those of the finest texture being of the greatest value. They are then placed in a steam chest and steamed, by which process the material is softened and rendered easy to cut. A vertical revolving circular knife, operated by steam power in the same manner as an ordinary circular saw, now divides the sheets into narrow lengths and again cuts them into small squares—the dimensions of the latter being governed by the size of the corks into which they are to be made. It is well known, that, in order to cut cork, a drawing motion must be given to the knife. Crushing strokes simply break off small pieces, and attempts to whittle the substance will show still more plainly that the knife edge must be drawn lengthwise and not forced downward. It is on this principle that cork cutting machines are constructed. Steel mandrels, made hollow, with cutting edges like those of a shoemaker's punch, are made to revolve with great rapidity. Pieces of cork pressed against their cutting edges become almost immediately smooth perfect cylinders. These are placed in grooves on the circumference of a wheel which, working automatically, carries each cork to a point where its ends are received by a small lathe. The cork is then revolved slowly, while a large circular knife removes a thin shaving, thus giving it the necessary taper and a surface as true and smooth as if sand-papered. As fast as a cork is finished by the automatic lathe, it is released and another substituted in its place.

Some manufactories do not make use of the mandrel and automatic lathe as above described, but employ another form of machine which is much simpler in arrangement though less efficacious in action. It consists of a horizontal revolving knife of some two feet in diameter arranged on a frame with belting, etc. The workman, sitting in front of the machine, places one of the square bits of cork, which have been previously cut of the required size, into a revolving spindle by which it is firmly held. This spindle is raised a measured distance and the edges of the cork come in contact with the revolving knife, which pares them off, leaving the cork in a perfectly cylindrical form.

The operation is performed with great rapidity, the machine turning out some fifty gross per day. The size of the cork depends upon the distance the above mentioned spindle is raised, and the consequent quantity of the square piece which the revolving knife is permitted to remove. All sizes can be made on this machine, from the tiny stopper of the homœopathic vial, scarcely one quarter of an inch in diameter, to the four or five inch flat cork used to close jars of chemicals, etc.

The shavings made by these machines are all utilized—either as stuffing for cushions or life preservers, linings for refrigerators—cork being an excellent non-conductor of heat or cold—or for placing between floors or walls of buildings to deaden sound. Ground finely and mixed with india rubber, they also make a durable floor covering, resembling oil cloth.

The finished corks are sold by the gross, the present prices being 10 cents for the smaller vial sizes, $3 to $5 for the fine qualities used for closing champagne bottles, and from $10 to $12 for the extra large varieties. The use of machinery for this industry, introduced in this country in 1853, has proved a great saving of hand labor. It has been estimated that it would require *4,000 men* to be continually at work to supply New York alone with corks, if all had to be made by hand. There are at present 60 manufactories in the country, cutting and supplying corks to the value of $2,250,000 yearly.

THE NEW RAILROAD BRIDGE AT ALBANY.

The largest double track iron bridge ever built in this country has recently been completed, and now spans the Hudson river between East Albany and Albany. The work was commenced on May 24th, 1870, and the first stone of the substructure was laid on the succeeding June 25th.

The main bridge is 1,525 feet long, and consists of seven spans over the basin, thirteen feet three inches each from center to center of piers; four fixed spans over the main channel, 185 feet each, and a draw 274 feet long, with two openings of 111 feet each in the clear. The curve of the bridge over the basin is on a radius of 710 feet. The main bridge is thirty feet above low water, and eight feet above high water mark, and is constructed on a vertical curve having a rise in the middle of fifteen inches. The whole length of the bridge, together with its approaches, including an embankment crossing Van Rensselaer island, on the east side of the river, is 2,250 feet, thus being equal to 4,500 feet of single track bridge. The abutments and piers are built on pile foundations, 160,000 yards of stone being used in their construction. The draw weighs 700,000 pounds and can be worked either by steam or by hand, the engine and boiler of ten horse power being located beneath the roadway.

The superstructure consists of 2,000 tuns of iron, mostly wrought, its trusses being twenty-six feet apart in the clear. The tension bars are made of double refined iron, and the fabric is calculated to stand a load of 6,000 pounds per lineal foot, exclusive of its own weight. The strain to which the bridge would be subjected under this load would not exceed one sixth of the breaking weight. It is estimated that the structure would sustain a continuous train of locomotives on each track, reaching from end to end of the bridge.

The entire cost of the structure was one million dollars. It is at present used for the crossing of freight trains and also for foot passengers, pathways on either side of the tracks being provided. The regular trains of the Hudson River road will not discontinue crossing the old bridge until the new depot in Albany, which has just been begun, is completed.

Messrs Bagley and Hilt, both well known bridge builders were entrusted with the supervision of the work, and Mr. Charles Hilton of Albany was engineer-in chief.

Hints on Coloring Photographs.

The increasing demand for colored photographs, either as *cartes de visite*, stereoscopic enlargements, or slides for the magic lantern, opens a suitable field of labor for the educated of either sex: in fact, they are the only fit persons to undertake it, as it requires a lightness of touch not generally possessed by those accustomed to labor. But none can hope to succeed without some degree of talent, and who have had a sufficient practice in the use of colors to enable them to paint a tolerable picture without a copy, not a vile travesty of some chromo-lithograph, which is often the only practice afforded to school pupils. No particular box of colors, however prepared, will bridge over the want of experience.

Should any wish to follow this branch of art, let them color a prepared photograph to the best of their ability, and then show it to some respectable publisher, who will, no doubt, give an honest opinion on its merits; and should this be adverse, unless the time and expense of further practice can be conveniently spared, it would be better to lay aside the idea, otherwise time might be wasted, during which opportunities might be lost that might never again be offered.

The greasiness of the surface of albumenized paper offers some obstacle to the uninitiated, but this is easily overcome by adding a little prepared ox gall to the colors used, or even by passing the tongue over the surface. The greatest drawback I have found has been the difficulty of obtaining purity of tints in the half shades and reflections of the flesh, owing to the muddy brown color to which the print has been toned, a sort of smudge, which no transparent color can remedy. This, and the tendency of silver prints to become yellow by age, has often caused me to consider whether it might not be better, when they are especially prepared for coloring, to use some other process which would give more favorable tint for working upon. As I believe any variety of tint can be given in carbon printing, this, with its permanence, would point it out as the most preferable, but would, probably greatly increase the expense of a single copy only.

When oil colors are to be used, two or three coatings of weak size, made of gelatin, should be given to the print beforehand, and allowed to dry. As in water, transparent colors can be used, and the effect much improved by touching the high lights with opaque ones.

In portraiture, should the painter be sufficiently master of his art to paint a good picture in the usual way, he will find it much better to use the photograph as a copy than as a substratum.

Transparencies on glass must always receive a weak coat of varnish before coloring, otherwise dabbing in the skies will do injury to the impression.

It should be understood that there is a great difference between coloring—that is tinting—a photographic print and painting upon one; the former requires little more than manipulation, the latter the skill of a well trained artist.

Retouching negatives also offers suitable employment, especially for female artists, as it requires light and delicate handling. I should think that an artist capable of retouching from the life—that is, taking sittings from customers—would be considered a desideratum in many photographic establishments, and be liberally remunerated.—*Photographic News.*

How the California Fields are Plowed.

The fields are plowed with what are called gang plows, which are simply four, six or eight plow shares fastened to a stout frame of wood. On the lighter soil, eight horses draw a seven gang plow, and one such team is counted on to put in 640 acres of wheat in the sowing season; or from eight to ten acres per day. Captain Gray, near Merced, has put in this season 4,000 acres with five such teams—his own land and his own teams. A seed sower is fastened in front of the plow. It scatters the seed, the plows cover it—and the work is done. The plow has no handles, and the plowman is, in fact, only a driver; he guides the team; the plows do their own work. It is easy work, and a smart boy, if his legs are equal to the walk, is as good a plow man as anybody—for the team turns the corners, and the plow is not handled at all. It is a striking sight to see ten eight horse teams following each other, over a vast plain, cutting "lands" a mile long, and when all have passed, leaving a track, forty feet wide, of plowed ground. On the heavier soil, the process is somewhat different. An eight horse team moves a four gang plow, and gets over about six acres per day. The seed is then sown by a machine which scatters it forty feet, and sows from seventy-five to one hundred acres in a day, and the ground is then harrowed and cross harrowed. When the farmer in this valley has done his winter sowing, he turns his teams and men into other ground, which he is to summer fallow. This he can do from the first of March to the middle of May; and by it he secures a remunerative crop for the following year, even if the season is dry. This discovery is of inestimable importance to the farmers on the drier parts of these great plains. Experience has now demonstrated conclusively that, if they plow their land in the spring, let it lie until the winter rains come on, then sow their wheat and harrow it in, they are sure of a crop; and the summer will have killed every weed beside.

How Summer Suits should be Washed.

Summer suits are nearly all made of white or buff linen, pique, cambric, or muslin, and the art of preserving the new appearance after washing is a matter of the greatest importance. Common washerwomen spoil everything with soda, and nothing is more frequent than to see the delicate tints of lawns and percales turned into dark blotches and muddy streaks by the ignorance and vandalism of a laundress. It is worth while for ladies to pay attention to this, and insist upon having their summer dresses washed according to the directions which they should be prepared to give their laundresses themselves. In the first place, the water should be tepid, the soap should not be allowed to touch the fabric; it should be washed and rinsed quick, turned upon the wrong side, and hung in the shade to dry, and when starched (in thin boiled but not boiling starch) should be folded in sheets or towels, and ironed upon the wrong side as soon as possible. But linen should be washed in water in which hay or a quart bag of bran has been boiled. This last will be found to answer for starch as well, and is excellent for print dresses of all kinds, but a handful of salt is very useful also to set the colors of light cambrics and dotted lawns: and a little ox gall will not only set but brighten yellow and purple tints, and has a good effect upon green.

Boiler Explosions.

Our esteemed correspondent, John Wise, of Philadelphia, Pa., in the course of a letter on this subject, makes the following communication:

"Why not make boilers egg-shaped? At all events, make them strong enough, as are made the big guns of warfare, so that they may bear, not double or treble their nominally guaranteed pressure, but strong enough, like Perkins', to bear a red heat, and then we shall no longer call for daily coroners' juries to inquest the steam boiler slain.

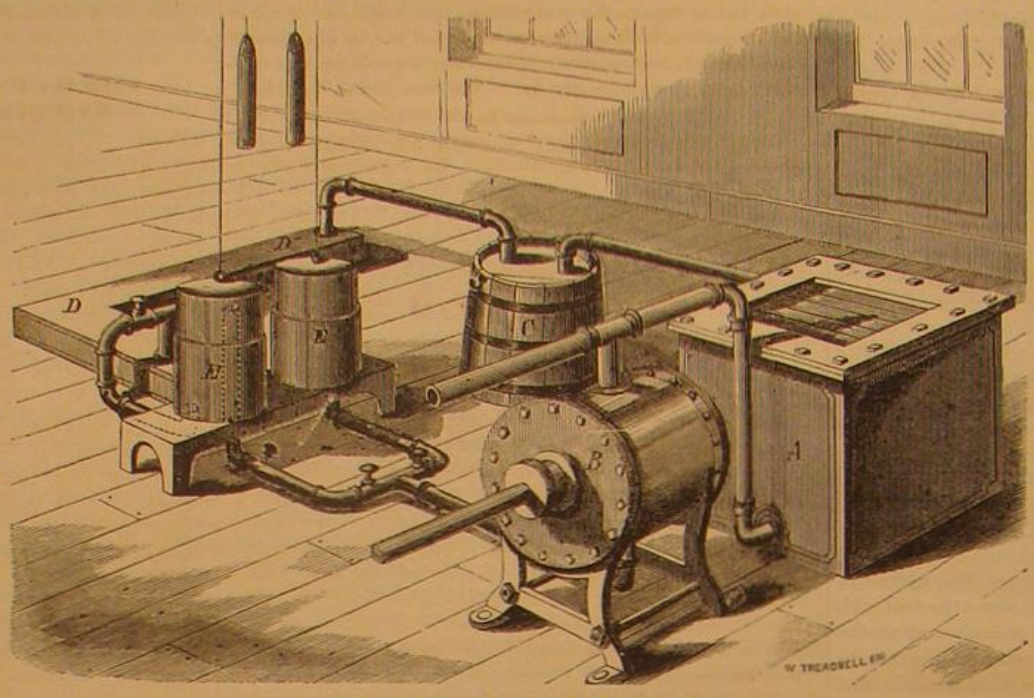
"It is seldom we hear of a steam chambered fire box explosion. And why? Because they are well braced and staybolted. Brace and staybolt the boiler, with equal precaution as to form and material as to its work and incidents, and then, and not until then, will explosions of steam boilers become rare."

An exchange says: "Cleveland has invented a patent bug buster, worked with an air pump. All the apertures in a room are stopped but one, at which the deadly bug buster is placed. By exhausting the receiver, a current of air is produced strong enough to draw all the vermin out of the room, through the air pump, into the hopper, where they are put under the influence of chloroform, and stabbed in the back with a pitchfork."

We regret to hear of the death of Dr. Perry Prettyman who was one of the pioneers of civilization in Oregon territory. He migrated thither in 1847, and continued to reside there till the day of his death, March 27, ult. His age was 76, and his life has been made useful to his country by many inventions and improvements.

Improved Ice Machine.

The invention we illustrate consists of improvements in the method of, and machinery for, making ice by artificial means. At A is shown a tank, which is constructed of an outer chamber in which the freezing material is placed, and of an inner chamber to contain the water to be frozen. B is an air pump connected by a pipe with the freezing chamber in the tank; C is a vessel filled with oil or other hydrocarbon, into which the air from the freezing chamber is conveyed by a pipe from the upper part of the tank; D is a second oil vessel, which is connected by a pipe with the first; E E are two vessels having weighted covers; they are connected by pipes with the oil vessel, D, and also with the air pump, B, as shown in the engraving.



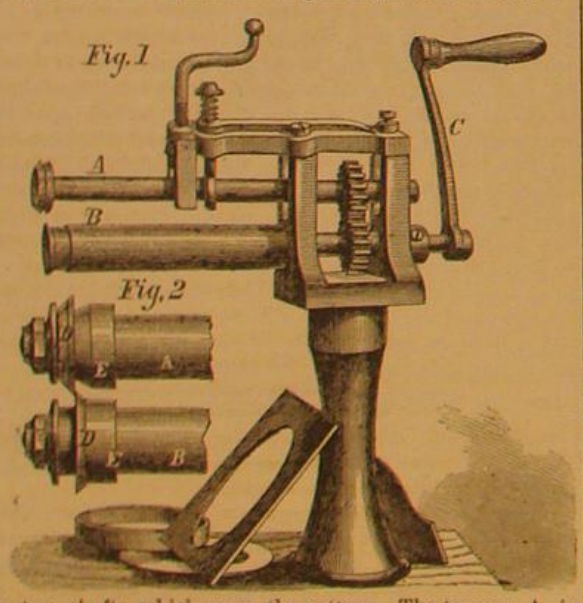
MACHINE FOR MAKING ICE.

The freezing substance considered preferable is bisulphide of carbon, although ether, rhigoline, or chloroform, may be employed. The operation is as follows: The air is forced by the pump, B, into the freezing chamber in the tank, A. There it passes through the bisulphide of carbon and becomes surcharged with it, abstracting the requisite addition of heat from the water chamber. The heat and vapor of the bisulphide are then carried, with the air, into the oil vessels, C and D, where they are eliminated and the air purified. The purified air is thence conveyed to the vessels, E E, from which it is returned to the air pump by weighting their covers after closing the inlet cocks. The oil, when it has absorbed as much heat and bisulphide as is expedient, is drawn off and distilled, and the agent employed is re-obtained in its original quantity and purity. By the means described, the air is quite, or very nearly, restored to its original purity and temperature before it is carried back into the freezing liquid, and difficulties attending the use of other similar apparatus are thereby overcome. A further improvement in the process consists in depriving the air current of the aqueous vapor with which it is always more or less charged, and which forms frost and ice in the pipes; this is accomplished by passing the air over chloride of calcium placed in the bottom of the pipe leading from the pump to the freezing chamber. The invention was patented through the Scientific American Patent Agency by W. R. Johnston and W. Whitelaw, April 30, 1872. For further information, address the Whitelaw Ice Machine Company, Memphis, Tenn.

BUNKER'S METAL CUTTER.

Our engraving illustrates a new machine for cutting metal with rotary knives, which is appropriate for tinners' use, and also for cutting iron that is too heavy for ordinary bench shears to act upon.

Fig. 1 shows the general arrangement, in which A and B



are two shafts which carry the cutters. The top one, A, is adjustable, by means of screws, to any required distance from the lower one. The two are geared together, as shown in the engraving, and turned by the handle, C. Fig. 2 shows enlarged views of the cutting and feeding apparatus attached to the ends of the shafts. The circular cutters, D D, overlap each other, so as to cut shear-fashion. Behind the cutters are rings or cylinders, E E, which press upon, and serve to feed, the metal to the cutters. The operation will be fully understood without further explanation. It is thought this machine will prove very useful for cutting off stovepipe, and for cutting out the holes for doors in stoves and furnaces. Several of the forms cut by it are shown at the foot of Fig. 1. Patented through the Scientific American Patent Agency, April 30, 1872. Further information can be obtained of the inventor, Mr. A. S. Bunker, 288 Common street, Lawrence, Mass.

Trial of Agricultural Implements.

The Ohio State Board of Agriculture have appointed a trial of agricultural implements and machines, to take place at Springfield, June 18, 1872. The following is a list of classes designated for competition, with the premium for the best of each description: Plow for general purposes, stubble plow, sod plow, double plow; premium in each case, a silver medal or $20. Subsoil plow, hill side plow, one horse plow, double shovel plow, a premium for each of a silver medal or $10. Steam plow, practical utility of operation to be fully demonstrated, $50; improvements in plows, diploma. Two horse grain drill, $10 and diploma; one horse grain drill, $10 and diploma; garden seed drill, $5; horse power corn planter, $20 and diploma; potato planter, $5; potato digger, $10; two horse corn cultivator, $20 and diploma; one horse corn cultivator, $10 and diploma; farm road scraper, $10; roller and crusher, $15; harrow, $10; mole or blind ditching machine, $20; post hole borer or digger, $5. In giving premiums on plows, the following points will be considered: Gross draft, weight, loss of power in overcoming friction, net power required to cut and turn the furrow slice, width of furrow slice, depth of furrow slice, comparative draft, simplicity of structure, materials, workmanship, durability, price, superiority of work. Competition is invited from all parts of the Union.

DURAND'S BURETTE.

This little appliance is the invention of M. Durand, of Saint Ouen, department of the Seine, France. Its operation will be readily understood on reference to the annexed illustration, in which *a* is the body of the can, *b* the long curved spout, and *c* c_1 a small tube in the form of a segment of a helical coil. This coil is affixed to the cover of the can and has one end, *c*, open to the air, and the other c_1, open to the inside of the can. In using the oil can when full of oil, all that is necessary is to cover the external aperture, *c*, with the thumb, which prevents any flow of oil from the spout, which is sufficiently small in diameter to prevent contrary currents. When it is desired to supply any lubricating reservoir, it suffices to uncover the aperture *c*, and thereupon the oil will flow in a small stream from the spout until the atmospheric pressure is again cut off from the interior of the oil can, after which no single drop will escape. This oil can is ingeniously simple and effective, and has been reported upon most favorably by a committee of the French Academy on Mechanical Arts.

Sea Weeds a Thousand Feet Long.

The Agassiz expedition, at the latest accounts, was off Sandy Point, Patagonia. Among the scientific curiosities noted by some members of the party were immense quantities of kelp, the *Macrocystis pyrifera*. This is the largest known *alga* or seaweed, and grows on these coasts in from six to twenty fathoms of water, in vast beds, warning the mariner to beware a near approach, unless he wishes to be entangled in an inextricable net work. It throws up from the oceanic depths stems of immense lengths, some of them from seven hundred to one thousand feet, the greatest development reached by any member of the vegetable race now in existence. Patches of this seaweed were passed in open sea, with large sea lions lying on its surface, who were apparently navigating in this novel manner with much satisfaction to themselves, and who afforded much amusement to their scientific observers.

False References.

A firm, hailing from Mississippi and purporting to be engaged in the business of selling patents under the style of Z. P. Dedrick & Co., are making unauthorized use of the name of Munn & Co. as a reference for their responsibility. Patentees will do well to keep clear of parties sailing under false colors.

To our Subscribers.

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A Simple Plan of Polishing Photographs.

Certainly a great number of my colleagues who have essayed the collodion and gelatin process for finishing photographs have met with many difficulties and uncertainties inherent to the method, and have, consequently, thrown it up; it was so with myself, and I went back again to an older plan of enamelling, which I had previously employed.

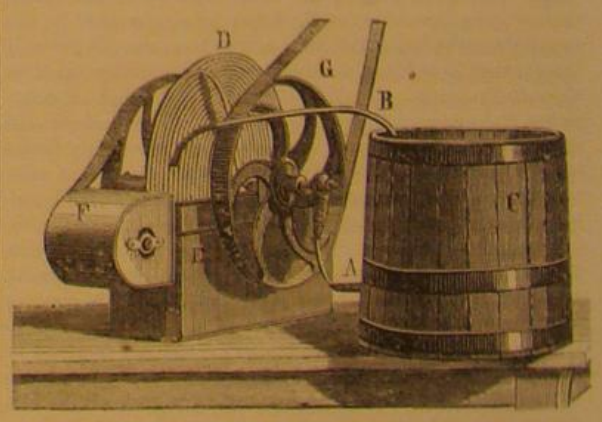
In the year 1865, I met with a photograph which had emanated from the studio of M. Dauthendey, of Wazburg, the picture being a bust with white oval margin upon a black ground. The photograph possessed a magnificent polish, and was of a very brilliant character; and experiments that I made with paper varnishes, etc., were all fruitless in giving the degree of finish possessed by the Dauthendey picture. Finally I came upon the following plan: I mounted about a dozen carte prints upon a card, covered them with a solution of gum—or, better still, gelatin—and when they had dried and been rolled and retouched, they were polished with a solution of white shellac in spirits of wine. This operation was conducted as if it was a question of furniture polishing, a rag being moistened with the liquid and rubbed to and fro over the prints for some time. The pictures, after standing the night, were again subjected to a second polishing.

Whenever the rag exhibited a tendency to stick to the surface, a minute quantity (say half a drop) of almond oil was applied to the photograph, and the operation of polishing continued. The photographs are subsequently cut out of the card. It is better to polish a number of small photographs at one time like this, as a large surface is more easily operated upon than a smaller one. The process is, probably, the same as that of M. Dauthendey, to be purchased for a honorarium of four florins.

The method, as already stated, is much to be preferred to the collodion and gelatin enameling process, so often recommended.—*C. Hoffman.*

DYNAMIC REFRIGERATOR.

Mr. J. B. Toselli, of Paris, France, has invented a cooling machine, which he calls the "Dynamic Refrigerator." It consists of a revolving disk, D, formed of a metallic tube bent into a complete spiral, having one end open, and with the other end communicating by a hollow shaft or axis of rotation with an external tube, A, communicating with a worm contained in a separate vessel, C, and terminating in a discharge pipe, B, with outlet into another vessel, E, containing the revolving disk, to which a slow movement of revolution is imparted by a driving pulley and belt, G, making, say, one turn in a second of time. The disk is half immersed in cold water, and as the exterior surface of the disk above water is continually wet, it exposes considerable evaporating surface. At the same time a continuous stream of water is forced through the hollow spiral, parting with some of its heat under the influence of the external evaporation and radiation which is intensified by the addition of a ventilator, F.



The current being thus lowered in temperature, refrigerates in its turn the liquid to be cooled in the vessel, C. The lowering of temperature thus obtained varies according to the hygrometric condition of the atmosphere; the minimum effect obtained, under the most unfavorable circumstance amounts only to a difference of 5° to 6° Fah., while the maximum difference obtained in sunlight is between 32° and 33° Fah.

This machine is obviously calculated to be of great service in many manufacturing processes—such as for brewing, distilling, and effervescent beverages—also in hydrotherapeutic establishments; and probably also on shipboard for the evaporation and distillation of sea water, and its conversion into a potable fluid.—*Mechanics' Magazine.*

ACOUSTIC EXPERIMENT.—Let a wide glass tube, open at both ends, be taken, and in this a piece of fine wire gauze be pushed up some little distance. If the gauze be now heated to redness, over an ordinary Bunsen burner, and then removed, it will shortly emit a shrill note, lasting from five to ten seconds. The experiment will be new to most of our readers, and has the merit of always going off.—*Journal of the Franklin Institute.*

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METEORITES, THEIR ORIGIN.

It is a most curious but, notwithstanding this, a well established fact that sometimes stones fall from the sky, and formerly the most absurd hypotheses were invented to explain their formation, in the upper strata of our atmosphere, by the condensation of vapors of solids, as hailstones are formed by the congelation of the vapor of water. Towards the end of the former century, La Place sought their origin at a greater distance; he concluded that as gravitation on the moon is some four times smaller than on the earth, it might be possible that the volcanoes there could propel stones with such a force as to go beyond the limits of lunar attraction into the sphere of terrestrial gravitation, as a velocity double or triple that which we can give to a cannon ball would be sufficient to accomplish this result; this hypothesis was accepted for a time, notwithstanding the objection of astronomers and chemists, the former proving that the observed velocity of the bodies and the force with which they strike the earth were much greater than they could possibly obtain from a source so near as the moon; in fact, astronomers proved that aerolites possess a planetary velocity. Chemists, from their side, pointed out that the chemical composition of aerolites was by no means that of matters ejected from volcanoes, but that they were compounds of metals, as found in earth, but combined in a way different from any terrestrial mineral known; in fact, that the greater number of aerolites were imperfectly mixed alloys of iron and nickel, with 4 to 14 per cent of phosphorus, the iron being on the average present in the quantity of 60, the nickel of 21, per cent. Chladni, in the beginning of this century, founded his theory in regard to the origin of the aerolites on the opinion of Kepler, who maintained that there were more comets and smaller bodies of different kinds flying about in space than fishes in the ocean. Chladni's theory was that, in the interplanetary and interstellar spaces, small masses of solid matter are moving about in countless numbers, either in regular or irregular orbits, and that when they happen to come within the sphere of gravitating attraction of any planet, they will fall towards the surface with a velocity the resultant of their own planetary velocity *plus* the newly acquired velocity of gravitation, *minus* the resistance of the air which surrounds the planet. On reaching its surface, these velocities are destroyed, and the necessary consequence is the evolution of heat, this being nothing but molecular motion, the metamorphosis of mass motion when the latter is forcibly prevented from continuing. This accounts for the heat of the masses when picked up immediately after their fall, while the train of fire exhibited in many instances is easily explained by the consideration that they originally may contain combustible substances which had no chance to burn in the highly rarefied interplanetary medium; but, coming in contact with the oxygen in our more dense atmosphere, and that with the immense planetary velocity, the friction, combined with chemical action, raised the temperature rapidly to the point of combustion.

The latest theory in regard to their origin is that of Proctor, in England. It is based on the recent investigations of the solar atmosphere by means of the spectroscope and telescope, which show that continually the most gigantic eruptions take place in the solar surface, throwing up gaseous matter containing iron vapor, etc., at an initial velocity of more than 500 miles per second to a hight of over 200,000 miles. Proctor thinks that if any denser material is ejected from the bowels of the sun by these explosions, it will never return to the sun again, and will fly off into space, revolve for some time around some planet, and finally descend on the same, as the meteors do on earth. If this view be correct, the specimens of meteoric iron preserved in our cabinets are pieces of the sun.

If we take in account that the spectroscope shows that the most prominent substance in the sun is iron, and that the same is the case in the meteorites, that they are combined chiefly with nickel, another metal found in the sun, forming an ally not found on earth: that they also show a peculiar crystalization, and in general a common origin, the view is by no means so improbable, however startling it may be; it is moreover sustained by the unanimous testimony of all modern observers, who affirm that the solar eruptions surpass in immensity any volcanic eruption which ever takes place on earth, or which, in past ages, must have taken place on the moon.

THE EIGHT HOUR STRIKE IN NEW YORK.

The progress of the eight hour movement here, which until recently appeared successful, has encountered a check which bids fair to result in defeat. Elated by the easy victories gained over the smaller employers, the strikers have carried the war to the doors of the great manufacturing firms and corporations. But here a strong opposition has been encountered. Hitherto the action of the strikers has been characterized by but few breaches of the law, and the public has been led to believe that the revolution might be effected without the usual recourse to riot and violence. This in the beginning was the opinion held by us, but the late reports of the new position taken by the workmen indicates that our city is likely to be disgraced by acts of lawlessness.

This eight hour movement affects every working man in the land, and unless all or a very large majority of the laboring classes afford it an unwavering support, the accomplishment of its design is impracticable. This encouragement from other localities has not, with the exception of a few trifling instances, been accorded. The leaders of the uprising are fully aware of this fact, and, stung by disappointment and at the same time forced to contend against unlooked-for and powerful resistance, they rush desperately to the last extremes, and endeavor, by threats of personal violence, incendiary documents, and other methods of brutal intimidation, to enforce the ends which they have failed to accomplish by peaceful measures.

We marvel that any sensible mechanic can lend himself to such proceedings and virtually take the bread from the mouths of his family or devote the little sum he has laid aside for a rainy day to the furtherance of such principles.

Organized gangs of malcontents have of late infested the surroundings of our large manufactories, seeking to induce the operatives, by persuasion or argument, to join their ranks. Now, however, their policy seems to have changed, and with the utmost audacity they enter the buildings, spread through the shops, and compel the workmen, who may be perfectly satisfied with their hours and their wages, to abandon their labor; and this in direct contempt of the remonstrance of the manufacturer or corporation on whose premises they may be trespassing. The hands having been enticed away or forced to quit work, the next proceeding is a declaration of terms on the part of the League to the employer, coupled with the information that, under no other circumstances save a compliance with the demands therein set forth, will he be permitted to continue his business.

The outrageous nature of these claims is illustrated by the following requisitions made to Mr. J. G. Batterson, the builder of the Masonic Temple on the corner of 23d street and Sixth avenue in this city, and communicated by him to the *Hartford Times*. Mr. Batterson had last fall resisted the strike at his quarry at Westerly, R. I. and has ,continued to cut granite under the system hitherto maintained, with a certain number of apprentices and last year's rate of wages. He carried that through successively and is now met by the stone cutters in New York with a declaration that he can only be permitted to carry on business in this city by complying with the following exactions: 1st. He must *throw away* all the cut stone which has been wrought during the past six or eight months by "non-society" men and apprentices—amounting to about twenty-five thousand dollars in value—and have it all done anew out of new stone by "union" or "society" men. 2nd. He must reimburse the various trades' unions who contributed money to support the striking workmen in the Westerly quarries, or, in other words, he must pay them all they expended in the attempt to break him down. 3d. He must dismiss all apprentices and recognize the power of all trades' unions. Extra emphasis was given to these requirements by the smashing of various ornamental parts of the cut stone about the building. Mr. Batterson refused acquiescence, appealed to the police for protection—and also continued work with men from his quarries at Westerly.

The detail of a force of police to insure the security of the Masonic Temple and also to protect other threatened points called forth the memorial from the League to the Governor, which, as a specimen of matchless effrontery and insolence, we have never seen rivaled. Like the Southern confederacy, the strikers wish to be "let alone," and they protest against the unwarrantable interference of the police in their peaceful occupations of closing factories, threatening employers, and offering personal abuse and violence to workmen who refuse to agree to their wishes.

We sincerely trust that the Government, both municipal and State, will invoke the full power of the law to repress and punish every act of violence these men may attempt. Ample protection is due to every workman who wishes to continue his labor at old rates; the entrance of committees and delegations into factories should be prevented, and any riotous movement should be crushed with a promptness and severity that would teach these organizations, and bring home to the minds of trades' unions generally, the fact that the use of violence as a means of coercion is beyond their powers and that irresponsible associations, however numerically great, have no more authority than single individuals to abridge or violate the rights of the citizen.

THE PNEUMATIC RAILWAY BRAKE AND OTHER APPLICATIONS OF THE PNEUMATIC SYSTEM.

The pneumatic railway brake, or Westinghouse brake, which for several years past has been so successfully used on the principal railways in this country, is now attracting great attention in England, where it is considered a remarkable improvement. It is the invention of Mr. George Westinghouse, Jr., of Pittsburgh, Pa. It is used on twenty thousand miles of railway here. It has lately been adopted on the Caledonian railway of Scotland, a first class company. A locomotive and train of six cars has also been recently fitted with it on the St. Albans branch of the London and Northwestern railway, and on both of the above roads the invention has been subjected to the severest practical tests. The train, running at a velocity of 50 miles per hour on a level, was stopped in 16 seconds after turning the air on, within a distance of 260 yards. On a down grade of 1 in 68, train running 60 miles per hour, the stop was made in 23 seconds, within a distance of 308 yards.

The invention, it will be remembered, consists in having an air reservoir placed under the locomotive, in which reservoir a supply of compressed air is maintained by a steam pump. The compressed air is conducted, through lines of double pipes, to a series of air cylinders or engines, one of which is placed under each car for the purpose of working the brakes. In order to apply the brakes, the engineer simply turns a cock which admits air to all the brake engines in the train at once. Nothing could be more effective or convenient. An air pressure of 70 lbs. to the square inch is maintained in the reservoir.

The practical applications of the pneumatic system are becoming yearly more and more various and extended. In London, there are now in operation some nine miles of pneumatic tubes, for the conveyance of letters, etc., under the surface of the streets. For some ten or twelve years, passenger trains were regularly operated on one of the Parisian railways by the pneumatic plan, while in Great Britain, during a series of practical trials with the same system, passenger cars were propelled at a velocity as high as sixty miles per hour. It is true that this method of propulsion has not yet been reduced to the same point of economy that is realized with the steam locomotive; but there are situations where the employment of steam is for special reasons so undesirable that even at an increased expense, a good substitute becomes necessary. As for example, for city railroads, the pneumatic plan, which furnishes rapid speed and pure air, is decidedly preferable to a steam road, which whether placed above or below ground is more or less of a nuisance to everybody.

Another important application of the pneumatic system relates to rock drilling, and is now very extensively employed for that purpose. It was used in the boring of the great railway tunnel through the Alps. It is also employed at the tunnel now being bored through the Hoosac mountains, Massachusetts, which, next to the Alpine tunnel, is the largest work of the kind. The pneumatic drills are also used in boring the net-work of tunnels under the East river, at Astoria, N. Y. In all of these examples a pneumatic pressure of about 60 lbs. to the square inch is used.

Another very beautiful and successful application of the pneumatic system is employed in the construction of the foundations of bridges under water. The great bridge over the Mississippi at St. Louis is an example, the foundations of which were carried down, one hundred and thirty-six feet below the level of the water, by the maintenance of a pneumatic pressure within the caissons of some fifty-two pounds to the square inch. The same system was employed here in the sinking of the foundations of the Brooklyn suspension bridge.

IRON SHIP BUILDING IN WILMINGTON.

Among our maritime manufacturing cities, Wilmington, Del., must now be held to take a very prominent position. During the last eight or nine years, the energies of her capitalists have been directed to iron shipbuilding, and great success has resulted from their efforts.

The city is naturally well situated for shipbuilding purposes, and the facilities for obtaining iron are unexcelled. Two railroad lines extend to the mining regions of Pennsylvania, and the ore is brought by them directly to the shipyards. The latter are all located on the Christiana Creek—a wide and deep stream which forms a junction with the Delaware River at Chester, Pa. Adjacent to Hollingsworth and Harlan's yard is a large dry dock, only rivalled by that at the Brooklyn navy yard, which has just been completed by that firm at a cost of $125,000. The basin is of solid granite, built in terraces. The above firm alone employs 700 mechanics, and another, 500; the whole number employed by the various builders is, according to a correspondent of the *Evening Post*, about 3,000, which is rapidly on the increase with the extending business. The builders

roll their own iron plates and manufacture everything pertaining to an iron vessel themselves. Many magnificent steamers have been built at this yard, the workmanship of which would bear comparison with that of the finest Clyde-built vessels. There are now on the ways a vessel of 3,000 tuns intended for the Pacific Mail Steamship Company, and one of 1,500 tuns for the Cromwell line. At the yard of Pusey and Jones, over sixty iron vessels for different lines have been built during the last seven years, and at present they have on the ways a 3,000 tun ship for the South American trade.

The business of the other builders is also in a flourishing condition, and there is every prospect of Wilmington becoming the great center, on our continent, of this branch of industry.

HOW PAPER COLLARS ARE MADE.

One hundred and fifty million paper collars, it has been estimated, are yearly used in the United States; and statistics show that even this immense number is steadily increasing as improvements in the manufacture multiply.

The collars are made in two varieties: of paper and cloth combined and of paper alone. The best materials are used in the manufacture of the paper. It is supplied in heavy white sheets, sixteen by thirty-six inches in dimensions, weighing 125 pounds to the ream. On being received in the manufactory, it is sent to the enameling room, where each sheet is covered with a thin layer of enamel and then placed on racks heated by steam pipes until thoroughly dry. This work is performed entirely by hand, and the enamel mixture applied with an ordinary brush.

After the sheets have become thoroughly dry, they are embossed to imitate cloth. To produce this effect, muslin is tightly stretched and pasted on plates of tin corresponding in size to the sheets of paper. Between pairs of plates thus prepared, the paper is laid, about fourteen sheets at a time being thus arranged, making a pile of alternate layers of paper and tin. The whole is then passed between heavy steel rollers, the pressure being sufficient to imprint the threads of the cloth on the paper, so that a perfect *fac simile* is thus obtained.

Each sheet is then polished by passing it over swiftly revolving brushes, when it is ready to be transformed into collars. The paper is next sent to the finishing loft, where, by means of movable dies made of steel, with edges sharpened so as to penetrate the material readily, the collars are cut out. A heap of sheets, about eighty in number, is arranged under a press, the die placed upon them, and the press set in motion. A single stroke cuts through the paper, and the collars are shaped. They are now perfectly flat, destitute of button holes, and, besides, must be molded before they are ready for packing.

At one end of the loft are large rolls of starched muslin, the use of which it is at first somewhat difficult to divine. A glance at the next process through which the collars pass soon affords an explanation, for the muslin is seen cut up into little elliptical bits called "patches" which are pasted on the extremities and middle of the collar. Their object is to give the button holes the necessary strength and to prevent them tearing out when soaked by perspiration. A very ingenious machine puts on these patches, cuts the button holes, impresses the imitation of stitches on the borders, folds the collar, and stamps its size on it, all in one motion.

The collars, as fast as they are finished by this machine, are bent or molded so as to fit the neck. The molding apparatus accomplishes its work with astonishing quickness, although it may be fairly considered as rivalled in rapidity of motion by the girls who pack the collars in the boxes. A bundle of a dozen is made up and twisted into its receptacle as if by magic, each girl packing some 20,000 collars per day. The last process is to label the boxes, place them in cases, and the goods are ready for the market.

The cloth lined collars are the more expensive of the two varieties. They are made of paper to which muslin, either white or colored, is firmly pasted, so that no embossing is necessary, and are cut out and finished in the same manner as above described. Cuffs and false shirt bosoms go through the same processes, dies being used of the required forms. This manufacture is largely carried on in this city.

AMERICAN INVENTIONS IN EUROPE.

Several American improvements of a valuable character are now attracting public attention in England and on the Continent. One of these is the Danks puddling furnace, by means whereof mechanism is successfully substituted for manual labor in the production of puddled iron. This is the invention of Samuel Danks, of Cincinnati, Ohio, and its introduction is acknowledged by the iron masters of England to have effected a revolution in the puddling business. It reduces the cost of making the iron at least five dollars per tun. Another improvement is the Henderson process of making iron and steel, the invention of James Henderson, of New York city. The object is to remove the phosphorous and other impurities from the pig iron, and convert it into fine wrought iron or steel at one operation without either mechanical or manual puddling. This is accomplished by melting the iron in connection with fluor spar, ilmenite, and manganese. Some very remarkable results have been obtained. At a trial at the Blockhairn ironworks, Glasgow, pig iron containing 1·14 per cent of phosphorus was melted, and in 50 minutes after fusion only ·12 of phosphorus remained, and in the finished wrought iron, only ·07.

Another invention is the pneumatic railway brake of George Westinghouse, Jr., of Pittsburgh, Pa., already in extensive use in this country, but now just being introduced abroad. In this improvement, the brakes are operated by compressed air, supplied from a reservoir placed under the locomotive, a special pump being employed to effect the compression. The practical results obtained in England are considered remarkable by the railway authorities there.

THE SIGN BOARDS OF NEW YORK.

New York presents on her sign boards and in her streets a large series of odd combinations of letters, more *bizarreries* in color, form, and design, and probably a greater number of ingenious advertising dodges, than any other city in the world. Among the many of these striking devices which sometimes ornament, often disfigure, the fronts of the buildings on the great thoroughfares, the sign emblematical of the business pursued, though one of the oldest, seems to be one of the most popular modes of arresting public attention, and its manufacture is made a specialty by several well known firms. Broadway is prolific in odd conceits in this class of sign. A depot for homœopathic preparations displays, on its front, a huge white pellet; colossal gilded pipes are suspended over the doors of vendors of meerschaums, and the most prominent of all is an immense gilt eagle which, holding a basket in its beak and perched on the edge of a roof, is visible the whole length of the street, serving to advertise a manufactory of willow ware.

We miss the impossible counterfeit of the noble red man, for so long the favorite symbol of the tobacconist. Fashion has banished him from the aristocratic marts of Broadway to the less pretentious shops on the avenues; but his place is filled by elegantly painted images representing goddesses of liberty, base ball players, gorgeously attired damsels, or perhaps simply by the upper half of a smiling individual who, placed in the window, seductively beckons us to enter. These effigies carved from wood exhibit much artistic skill both in coloring and in model. A large proportion of them are made across the river, in Brooklyn; their cost is from fifty to two hundred and fifty dollars each. A leading hat firm decorates the roof of its store with a wooden bear: importers of toys favor figures of Santa Claus, and a speculator in dollar jewelry, on the Bowery, displays a banner on which an admirable representation of a one dollar greenback is painted.

New and odd conceits in trade mark signs make their appearance almost daily, those of the umbrella manufacturers being especially ingenious. One of the most striking is a representation of a philosophic individual, calmly seated, holding over his head an umbrella on which a youth pours buckets of water, the latter being furnished him by a third party who is represented as frantically pumping. Another firm in the same business symbolizes its trade by the picture of a South American guanaco, and obtains a still better advertisement by philanthropically distributing white sun umbrellas, on which the name of the manufacturer is printed in large letters, among the stage drivers and cartmen. In many instances, signs are made to advertise a business and at the same time prove valuable as public conveniences. Handsome clocks, surmounting iron columns placed on the sidewalk, are found in many parts of the city, bearing the names of jewelers. A safe manufacturer places an enormous wind vane, on one end which his advertisement is inscribed, on the edge of his roof so that it can be readily seen from the street, and a maker of optical instruments takes advantage of the popular curiosity as to the temperature of the weather by exposing his sign attached to a large thermometer.

Queer conceits abound, the very oddity of which makes them noticeable. An entire building in Broadway is constructed of iron after a Moorish style of architecture, and is painted and stencilled in patterns of every hue in the rainbow. The tea stores in Vesey street color their fronts bright vermilion and green, and ornament their interiors with Chinese lanterns and frescoes depicting scenes in celestial life. Signs with the letters upside down are often used, and sometimes the characters are so intermixed as to require some puzzling to decipher their meaning. A window glass manufacturer arranges the letters of his sign thus "W G I L N A D S O S W." Those pests of Broadway, the peripatetic individuals who carry banners, have happily been abolished, but their places are taken by others, who, dressed in ridiculous costumes, endeavor to force circulars into the hands of passers. Helmbold the druggist, before his failure, placed on the roof of his building the mast of a ship, fully rigged with yards, gaff, boom, etc. Each yard arm was decorated with a flag, and a huge burgee with the name "Daunter" floated from the mast head. A warlike effect was given to the whole by showing the muzzles of two "quaker" cannon protruding from the cornice.

One of the most ingenious devices was that of a photographer on Broadway. An automatic stuffed monkey was represented as taking the likeness of a female of his own species. The figures were ludicrously dressed and, by means of clockwork, made to go through various motions in a very natural manner. The sitter poses herself, the operator inserts the plate in his miniature camera and turns away as if waiting; after a short pause, he removes the plate, bows to the lady, who turns her head, adjusts her dress, etc., and the same performance is repeated.

A printer in Center street displays an effigy of a Chinaman who, worked by machinery in the inside of the building, assiduously turns a wheel on which the sign is inscribed. The fence surrounding the new Post Office contains the advertisement of a western railway, which is embellished by the stuffed head of a huge buffalo, said to have been killed by Prince Alexis. Carts driven around the city, covered with posters and gaily painted transparencies are not so common as formerly; their advent when they are used is generally quite forcibly announced to every body far and near by the continuous tolling of what is known as the "Tammany" bell. An enterprising individual recently caused considerable astonishment and not a little trepidation among the pedestrians on Broadway by leading a full grown lioness down the street. His advertisement was gaily painted on a cloth which was thrown over the animal's back.

The stereopticon and electric light have lately been employed for night advertising. By means of the former, pictures and business cards are alternately thrown on a large screen, the exhibition always attracting a crowd of spectators. The electric light is used to flash suddenly on the sign to which it is desired to draw attention. Very attractive signs for night use are those made from prisms or cut crystals and glass. The latter are imported from Prussia and set in frames of galvanized iron wire, made in the required shape. Inside the frame are placed revolving gaslights which produce, when seen from the exterior, a dazzling effect. A new way lately introduced of manufacturing these signs is to make the frame of cast iron and set in glass bulls' eyes of different colors. They cost from fifty to one thousand dollars, the price depending on the size. Cups of colored glass, each containing a gas jet and arranged in the form of letters, devices, etc., are also used for illuminated advertisements.

There are not many novelties of late invention in sign making. A heavy wire network on which are fastened large wooden letters is being introduced as a roof sign. Block letters made of sheet brass and nailed to the sign board have lately come into the market and present an effective appearance. For smaller placards, mirrors are very handsome. The design is traced on the back by removing portions of the amalgam, and made prominent by the glass being placed against gilt or colored paper. In banners, those made from network, with strips of canvas on which the sign is painted fastened upon them, have superseded the large pieces of canvas. The former are lighter and much more durable, as they are not apt to blow to pieces in a high wind.

DEATH OF JAMES GORDON BENNETT.

Among the prominent men recently deceased is James Gordon Bennett, founder and proprietor of the New York *Herald*, aged 75. So far as concerns the ethics of journalism, he was unscrupulous and irregular, zealously advocating the cause of truth and justice on one day, but perhaps the very next day assailing the same cause with unworthy vehemence. Editorially regarded, the *Herald*, under Mr. Bennett's *régime*, was notoriously unreliable; but as a vehicle of news it was the embodiment of enterprise, and in this respect it outranked all its competitors of the press. The New York *Herald* is one of the most widely circulated daily papers in the world, and as a property one of the most valuable. The establishment falls, by the bequest of its founder, to his only son, Mr. James Gordon Bennett, Jr. He is a young man of about 26 years, of considerable physical activity, chiefly famous as a sportsman, particularly in the yacht line. No king upon his throne ever possessed such power for good or evil as that now wielded by young Mr. Bennett in the New York *Herald*. That he may use his great inheritance honorably and wisely is the earnest wish of every person in this community.

QUICK MAILS.—The largely increased mails to be carried from Chicago to New York have induced the managers of railways to put on mail trains proper, each to consist of one locomotive and three mail cars, to be run through in twenty-four hours. Several cars are now building for this purpose, each fifty feet long and adapted for fast running. No stoppages are to be made except for coal and water, and it is intended that the distance (962 miles) shall be accomplished in the time stated, which would be running over forty miles an hour. Some such measures seem to be imperative, and will be attempted, at any rate, to relieve the Chicago and New York city post offices of an embarrassing glut of mail matter growing greater from month to month.

IMPROVEMENT IN FRACTIONAL DISTILLATION.—Linnemann has successfully applied to laboratory purposes the principles of a method largely used in the arts, in the construction of the so-called dephlegmators. This principle consists in partially condensing locally the vapor which rises from a boiling liquid, in such a manner that the vapors which subsequently rise shall pass through the condensed liquid, and thus in a certain measure be washed. The apparatus employed consists simply of a vertical tube, attached to the flask in which the liquid boils, and containing six or eight little caps of platinum wire gauze separated from each other by small intervals.

DR. JOULE, in some experiments lately made on the polarization, by frictional electricity, of platinum plates, has found that charge which they received was only diminished one half after an interval of an hour and a quarter. The plates were either immersed in water or were laid in alternate series, separated by wet silk. The amount of charge they took was measured by means of a delicate galvanometer. He has suggested that a condenser on this principle might be useful in researches on atmospheric electricity.

MILK OF DISEASED CATTLE.—Mr. Husson, in a paper upon the milk of animals diseased with the cattle plague, announces, as the result of one of his researches, that neither the flesh nor the milk of animals suffering from this cattle plague—contagious typhus—will convey the disease, although they may suffer greatly in their nutritive properties. The milk of diseased cows he found to have a more or less marked reddish yellow tinge, and a disagreeable flavor, although cats fed upon it seemed to suffer no inconvenience.

SCIENTIFIC AND PRACTICAL INFORMATION.

NEW METHOD OF MAKING BORAX.

When an alkaline sulphuret is added to an aqueous solution of boracic acid, the water is decomposed; the hydrogen, replacing the metal, forms sulphuretted hydrogen, while the oxygen goes to the metal to form a base, which then combines with the boracic acid thus:

$$SNa + 2BoO_3 + HO = HS + NaO, 2BoO_3.$$

This property may be used in the manufacture of borax from boracic acid. The carbonate of soda heretofore used for this purpose is much more expensive than the sulphuret, since in the manufacture of soda the sulphate is first reduced to the sulphuret which is afterwards converted into the carbonate. By making use of the sulphuret instead of the carbonate, this last and difficult step of the operation is dispensed with. The sulphuretted hydrogen given off may be either employed in the manufacture of sulphuric acid, it being converted into sulphurous acid by burning, or the sulphur itself may be obtained from it by bringing it into contact with sulphurous acid.

LIQUID LENSES.

A new and beautiful lecture experiment has been adopted by Professor Henry Morton, which illustrates very forcibly the action of refraction. A magic lantern is arranged vertically in connection with suitable mirrors to throw the image upon the screen. An empty watch glass is substituted for the usual objective lens. If now we introduce an object, as for example a photograph on glass of course no image will be produced on the screen, but only a nebulous patch of light. On pouring water into the watch glass, however, a well defined image is produced. On replacing the water by alcohol, muriate of tin, or other more highly refracting liquid, a lens of higher power is obtained.

HOUSE BUILDING.

A paper on this subject, read by Edward Roberts, F.S.A., before the Royal Institute of British Architects, closes as follows:

1. Never allow pervious drains in pervious soil.
2. Never allow a cesspool or drain near a well.
3. Never select gravel as a building site if well drained clay can be obtained.
4. Never allow drinking water to be drawn from a cistern supplying a water closet.
5. Never allow waste pipes to be inserted into water closet traps.
6. Never allow rain water to run to the ground, if it is required above.
7. Never allow water to stand in pipes exposed to frost.
8. Never allow pipes to be fixed so that they cannot empty themselves.
9. Never ventilate except by pipes or tubes, inlets and outlets being of equal size.
10. Never use glazed earthenware pipes for upward flues.
11. Never allow chandeliers to be the exclusive light, merely because it has been customary.

INDUSTRIAL EXHIBITION AT NEWARK, N. J.

Arrangements are now being completed for holding an exhibition at Newark, N. J., in August next. The specimens exhibited will be classified as follows: (1) Fine Arts and Education, (2) Dwellings, (3) Dress and Handicrafts, (4) Chemistry and Mineralogy, (5) Engines and Machinery, (6) Intercommunication, (7) Agriculture and Horticulture, (8) Tools and Hardware. No premiums or anything in lieu thereof are to be awarded to exhibitors, and the merits of their productions will thus be pronounced upon by the public solely and wholly. Messrs. Marcus L. Ward, A. M. Holbrook, and Isaac Gaston are respectively the President, Secretary, and Treasurer of the exhibition.

A farmer in Connecticut is said to have contrived an infernal machine for the destruction of crows, in the shape of a kernel of corn which explodes on being picked up by the unsuspecting bird, and blows his "durned eturnul head off" without the slightest warning.

Facts for the Ladies.—Louisa Kelley, Ackworth, Ga., has, with the general use of a Wheeler & Wilson Lock-Stitch Sewing Machine, for three years supported a family of four adults and two children, built and paid for a house, and has $100 cash on hand. See the new improvements and Woods Lock-Stitch Ripper.

Burnett's Cocoaine gives luxuriance to the hair.

The People's Friend.—It is susceptible of easy proof that the Sewing Machine has been a greater blessing to the masses of American people than any invention of the present century. Nothing else has done so much to save the lives and health of the wives and mothers, the patient, overworked women of the land, who, as a class, most needed relief from the burthens of everyday life. Every father and husband fails in his duty if he neglects to endow his home with such a triumph of science as the Wilson Under-Feed Sewing Machine. It is the cheapest and best sewing machine ever offered. Salesroom, 707 Broadway, N.Y.; also for sale in all other cities in the U.S.

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.

Wanted—Situation as Book-keeper in some good manufacturing business. Can invest means, if satisfactory. C. S. B., Box 929, Cincinnati, Ohio.

Drying Glue—Wanted an artificial, economical, rapid process, in all weather. Address Glue, P. O. Box 6783, New York.

Rapid Evaporator—Simple, 6 ft. sq., no pumps, no attendance, evaporates 4 gals. a min. at temp. under 175°. Address P. O. Box 6783, N.Y.

Wanted—A first class Sewing Machine Repairer. T. Shanks, Baltimore, Md.

Galvanized Slating Nails, Stove Reservoirs, and Hollow Ware. Address Cleveland Galvanizing Works, Cleveland, Ohio.

Machinery Paint, all shades. Will dry with a fine gloss as soon as put on. $1 to $1.50 per gal. New York City Oil Company, Sole Agents, 116 Maiden Lane.

Second hand Iron Planer, to plane 9 feet long, 33 inches wide—good as new and cheap. Chas. Place & Co., 60 Vesey St., New York.

Wanted—A party to make a wood workers' cast iron vise on royalty for the N. E., Middle and Southern States. No expensive machine work necessary. Crawley & Bayliss, Edgartown, Mass.

Moulds for Casting Soft Metals made to order. Die sinking the same. We will take a few small articles to manufacture. Send models and patterns. Guns reamed to order. Waterman & Co., West Meriden, Ct.

A steady mechanic, having some knowledge of pattern-making, wishes to perfect himself in that branch at some good shop in or near this city. Plenty of tools. Wages not an object. Address G. McNamara, 142 Nassau Street, New York.

Wanted—A Good Brass Moulder. A "steady" man can find constant employment by applying to Jas. Flower & Brothers, Detroit, Mich.

Wants to Buy one 4 foot Plane and one 4 foot Screw Cutting Lathe. Defiance Machine Works, Defiance, Ohio.

For Sale—Goodyears' Patent Hub Machine. Will turn 100 Sets Wagon Hubs per day. Defiance Machine Works, Defiance, Ohio.

Wanted—A partner in the Machinist and Foundry business, well established at Minneapolis, Minn. Address Chas. M. Hardenbergh.

Portable Baths. Address Portable Bath Co., Sag Harbor, N.Y.

Verdi Water Mills for Sale, with 400 acres of Land. Address J. A. Beam, Verdi, Kans.

Nickel Plating with or without Battery. Instructions of plating with new and unsurpassed solutions given on moderate terms by a practical plater. Address John Nagel, 83 East 7th Street, New York.

Standard Twist Drills, every size, in lots from one drill to 10,000, at ⅓ manufacturer's price. Sample and circular mailed for 25c. Hamilton E. Towle, 176 Broadway, New York.

The Shive Steam Engine Governor—Guaranteed to be the best in the world. Circulars sent free. Shive Governor Company, 12th and Buttonwood Streets, Philadelphia, Pa.

For the best Foot Power Jig Saw, address Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Dry Steam, dries green lumber in 2 days; tobacco, in 3 hours; and is the best House Furnace. H. G. Bulkley, Patentee, Cleveland, Ohio.

Hexagon Iron—superior quality for screws, &c., 9-16 in. 09½, ⅝ in. 09, 11-16 in. 09, ⅝ in. 08½, ½ in. 08, 1 in. 08, per lb. The above is price per bundle; single bars 2 cts. higher. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

For hand fire engines, address Rumsey & Co., Seneca Falls, N.Y.

T. Shaw's Steam Gauges, Ridge av. & Wood st., Phila., Pa.

If you want a perfect motor, buy the Baxter Steam Engine.

Brown's Coalyard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W. D. Andrews & Bro., 414 Water st., N.Y.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrew's Patent, inside page.

For Tri-nitroglycerin, insulated wire, exploders, with pamphlet, as used in the Hoosac Tunnel, send to Geo. M. Mowbray, North Adams, Mass.

All kinds of Presses and Dies. Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth St., Brooklyn. Send for Catalogue.

For Steam Fire Engines, address R. J. Gould, Newark, N. J.

Presses, Dies, and Tinners' Tools. Conor & Mays, late Mays & Bliss, 4 to 8 Water st., opposite Fulton Ferry, Brooklyn, N.Y.

In the Wakefield Earth Closet are combined Health, Cleanliness and Comfort. Send to 36 Dey St., New York, for descriptive pamphlet.

Best and Cheapest—The Jones Scale Works, Binghamton N.Y.

If you want to know all about the Baxter Engine, address Wm. D. Russell, office of the Baxter Steam Engine Co., 18 Park Place, N.Y.

T. Shaw's Blast Gauges, Ridge av. & Wood st., Phila., Pa.

Seeds and Fertilizers. R. H. Allen & Co., New York.

Callow's New Patent Mode of Graining Wood,
Makes Painters grain all woods first class who never grained before; Likewise makes Grainers lightning fast who thumbed it out before. Address, with stamp, J. J. Callow, Cleveland, Ohio.

Wanted—A Purchasing Agent in every city and county, to supply Nye's fine Sperm Sewing Machine Oil. Put up in Bottles, Cans, and Barrels, by W. F. Nye, New Bedford, Mass.

Presses, Dies & all can tools. Ferracute Mch Wks, Bridgeton, N.J. Also 2-Spindle axial Drills, for Castors, Screw and Trunk Pulleys, &c.

The Patna Brand of Page's Patent Lacing is the best. Orders promptly filled by the Page Belting Co., No. 1 Federal St., Boston.

Absolutely the best protection against Fire—Babcock Extinguisher. F. W. Farwell, Secretary, 407 Broadway, New York.

Boiler and Pipe Covering manufactured by the Chalmers Spence Non-Conductor Co. In use in the principal mills and factories. Claims—Economy, Safety, and Durability. Offices and Manufactories, foot E. 9th street, New York, and 1302 N. 3d street, St. Louis, Mo.

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

"Anti Lamina" will clean and keep clean Steam Boilers. No injury to iron. Five years' use. J. J. Allen, Philadelphia, Pa.

Williamson's Road Steamer and Steam Plow, with Rubber Tires. Address D. D. Williamson, 33 Broadway, N. Y., or Box 1309.

For the best Recording Steam and Indicating Gauges, address The Recording Steam Gauge Co., 91 Liberty Street, New York.

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

Belting as is Belting—Best Philadelphia Oak Tanned. C. W Arny, 301 and 303 Cherry Street, Philadelphia, Pa.

Boynton's Lightning Saws. The genuine $500 challenge. Will cut five times as fast as an ax. A 6 foot cross cut and buck saw, $6. E. M. Boynton, 80 Beekman Street, New York, Sole Proprietor.

Hydraulic Jacks and Presses, New or Second Hand, Bought and sold, send for circular to E. Lyon, 470 Grand Street, New York.

T. Shaw's Hydraulic Gauges, Ridge av. & Wood st., Phila, Pa.

Better than the Best—Davis' Patent Recording Steam Gauge Simple and Cheap. New York Steam Gauge Co., 46 Cortlandt St., N. Y.

To Ascertain where there will be a demand for new Machinery, mechanics, or manufacturers' supplies, see Manufacturing News of United States in Boston Commercial Bulletin. Terms $4.00 a year.

Rights for Sale—Of the only Patent out on Stove Pipe Fitters. Address Wm. Volk, 22 Staats Street, Buffalo, N. Y.

What I know about Machinery, especially Engines, Pumps, and Machinists' Tools, which I sell at 93 Liberty Street, New York. S. N. Hartwell, late agent for L. W. Pond.

The most economical Engine, from 2 to 10 H.P., is the Baxter

Over 800 different style Pumps for Tanners, Paper Makers, Fire Purposes, etc. Send for Catalogue. Rumsey & Co., Seneca Falls, N.Y.

The Baxter Steam Engine is safe, and pays no extra Insurance.

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.

Self acting Screen makes 6 grades Coal, ores, &c. A State right at a bargain. Geo. Lord, 232 Arch Street, Philadelphia, Pa.

Important.—Scale in Steam Boilers—We will Remove and prevent Scale in any Steam Boiler or make no charge. Geo. W. Lord, 232 Arch Street, Philadelphia, Pa.

Notes & 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.]

1.—MORTARS.—What is the size of the largest mortars used in modern warfare?—W. B.

2.—VARNISH FOR RUBBER.—Can any one inform me how to make a flexible varnish for rubber, so as to give it a gloss?—W. W. W.

3.—POWER OF SCREW DRIVERS.—Can more power be obtained by the use of a long screw driver than of a short one, both having the same sized handles?—W. H.

4.—PROPORTIONS OF SAFETY VALVE GEAR.—Can any one give me a clear and concise method of computing the position of weight on the arm of a safety valve, all things being proportional?—M. I. C.

5.—ELECTRO-SILVERING GERMAN SILVER.—Can some one inform me if silver can be deposited on German silver by electricity, so as to stand annealing at a low red heat without blistering? I have tried it in many ways, but failed, as small blisters almost invariably show themselves.—J. H.

6.—PROTECTING COPPER FROM THE ACTION OF MERCURY.—Can any of your readers tell me of any solution that will prevent mercury from adhering to or eating copper? I have tried shellac and copal varnishes, but find them only temporary in their effect.—G. S. D.

Answers to Correspondents.

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.

AQUARIUM CEMENT.—D. C. will find a recipe for a good one on page 207, Vol. XXV. of the SCIENTIFIC AMERICAN.

VELOCITY OF LIGHT.—G. M. V. points out an error in an article entitled "Celestial Space" on page 320 of the current volume. Light moves at 192,000 miles a second.

SUEZ CANAL.—To W. B.—The Suez canal is the property of a joint stock company, which the French Government helped to float by large concessions, "subventions," and guarantees.

F. W. G., of La.—You can make microscopic slides, showing the beautiful crystals of nitrate of silver, by placing a drop of the salt dissolved in water upon a slide and letting it dry. Then cover with glass in the usual manner. Use benzole, not benzine, in preparing objects. For many things Canada balsam is the best substance to use.

SUPPLY OF WATER.—To H. G., of Vt.—Your question, as we understand it, is this: Can the quantity of water supplied by a pipe be increased by using a larger pipe without any additional head? It can, up to the delivery of all the water in the spring. The head of water makes a pressure of so much per square inch on the area of cross section of your pipe, and the supply will increase with the size of your pipe, so long as there is enough water at the head. The pipe to the tub will not affect your supply at the mill, unless both are open at once, in which case the water conveyed from the spring will be divided between the two.

THIRTY TUN MAGNETS.—I have a bet with a gentleman. I stated that there had been a magnet built that lifted thirty tuns; he disputed it, and I agreed to leave it to you. Am I right? If not, what was the strength of the largest magnet? Answer: There was a paragraph published in the SCIENTIFIC AMERICAN some time ago describing the then new magnet built by Wallace & Sons, of Ansonia, Conn., for the Stevens Institute, in which it was stated that the estimated lifting force of that magnet was between thirty and fifty tuns. But President Morton, writing to us recently, states that its actual lift is probably only from four to five tuns. This is the largest magnet that we remember. Its poles are each three feet three inches long and six inches in diameter. The next in size is one lately constructed by Lord Lindsay in London, and is four inches in diameter of poles. There was one of some similar size at the College of Pharmacy, London, and that used by Faraday and Tyndall was in oblong section about three inches by four inches, and two feet long. If the power of electromagnets increased with their size, these large magnets might lift thirty tuns, but as a fact, they do not by any means. The largest magnet made prior to that of the Stevens Institute lifted about 2¾ tuns.

SUPERHEATING STEAM.—Query 1, page 354.—Let R. H. E. take a perfectly tight vessel, fill it completely with water, and he will be able to heat it (the water) to 400° Fah. without boiling, but the moment air is admitted, it instantly sinks to 212°. Now a little warning: If he heat it to 419°, the pressure would be 14,700 pounds per square inch, and at 507° it would equal 19,459 pounds to the square inch. The latter would support a column of mercury 3,243 feet in hight. (He will need a strong vessel.) The average latent heat of steam, as determined by the philosophers Watt, Southern, Lavoisier, Rumford, and Depretz, is 978° Fah., but Thompson says he does not think it can fall below 1,000°.—G. L. F.

PROPORTIONS OF ENGINE.—Query 8, page 354.—The small engine will do about 94⅝ per cent of the work that the larger engine is doing now.—P. R.

PROPORTIONS OF ENGINE.—Query 8, May 25.—An engine with a cylinder of 11 inch bore, 3 feet stroke, making 40 revolutions, will, with steam at 80 pounds pressure, be equal to 34⅜ horse power. An engine with 7 inch bore, 14 inches stroke, 150 revolutions per minute, with 60 pounds of steam, will be equal to 32⅛ horse power. Friction is not taken in account to either case. Deduct two horse power for friction, and you will have about the actual power of the engines.—A. H. G.

Declined.

Communications upon the following subjects have been received and examined by the Editor, but their publication is respectfully declined:

AERIAL NAVIGATION.—C. M.
DIVINING ROD.—H. E. F.—I. N. B.
FORCE AND COUNTER FORCE.—J. S.
FRUIT JELLIES.—I. D. T.
PETROLEUM AND THE PRECIOUS METALS.—J. H.
PRODUCING MOTION.—A. U.
PROPULSION ON CANALS.—P. J. D.—C. A. W.
ROTARY MOTION OF THE PLANETS.—P. R.
SCIENTIFIC RELIGION.—C. B.
THE FIRST STEAM RAILROAD.—D. M.
THE FLIGHT OF BIRDS.—R. O. D.
THE RUBBER TIP PATENT.—R.
VELOCITY OF LIGHT.—C. E.
WATER METERS.—F. G. W.
ANSWERS TO CORRESPONDENTS.—A. G. B.—K. L.—N. W. H.—J. F. K.—J. G. M.
NOTES AND QUERIES.—J. A. S.—F. O. H.—P. C. L.—J. D. P.

Recent American and Foreign Patents.

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

CANAL LOCK.—Israel Townsend, Caperville, Va.—The object of this invention is to economize water in taking boats through canal locks. This object is accomplished by the employment of a side reservoir, into which about half of the water from the full lock is drawn off to lower the boat. The passage between the lock and reservoir is then closed, and the remainder of the water in the lock is let off at the lower gate as usual. When it is desirable again to fill the lock, another passage from the reservoir is first opened and the lock is partially filled therefrom, thus using that portion of the water, twice, and thereby saving a proportionate amount of water.

IRON FENCE PANELING.—Floyd G. Brown, Chapel Hill, Texas.—The invention consists in manufacturing a fence or fence paneling of hoop iron, so that it may be sold in sections, of any desired length, rolled up in a compact form, easily and cheaply transported to any distance, and put up by the armer with rapidity and facility.

CHAIR SEAT FRAME.—Henry Buchter, Louisville, Ky.—The invention consists in improving the construction of a chair seat frame by using metallic corner pieces to connect the ends of rounds, whereby great strength and durability is given to that part of the chair which is subject to most strain.

BAG STRING INSERTER.—William J. Cussen, Richmond, Va.—The invention consists (1st) in a horizontal needle, having eye near the front and thread guide near the rear end; whereby a child can insert the gathering thread in a tobacco bag in one fourth the time in which it can be done with the hand by an adult. (2nd.) It consists in providing such a needle with a spring that not only guides but subsequently clamps the thread, so that it can be held taut while being cut off at the desired length. (3d.) It consists in providing a lever which shall simultaneously and by a simple movement place in position both clamp and cutter. (4th.) It consists in connecting the same lever that carries the thread cutter in front and finishes up the work, with a registering mechanism in the rear, by which the exact amount of work that has been done is always indicated.

FIRE ENGINE.—Jacob B. Van Dyne, Louisville, Ky.—The invention consists in arranging cylinders, provided with chemical ingredients which are mixed by the inversion of said cylinders, on pivots in the frame of a wheeled vehicle, and holding them in position by a latch. It also consists n providing the sides of frame with hooks upon which the ladder may be conveniently hung.

PROCESS FOR COATING IRON WITH ZINC.—John A. Grey and John Lippincott, Baltimore, Md.—This invention is an improvement on the common process of coating iron articles with zinc by dipping the articles in a bath of melted zinc resting on a stratum of melted lead within a pot of suitable size. By this process, no dross is deposited, and the wear of the article dipped will be practically nothing.

OYSTER CAN.—John A. Tillery, Baltimore, Md.—The invention relates to half square or narrow rectangular cans which are used in the trade for raw oysters, and it consists in forming a raised annular rib, about the channel in which the downward flange of the cap is soldered, for the purpose of preventing said channel from being, to a greater or less extent, filled by solder flowing from the joint between the top and body.

PEANUT THRESHER AND SEPARATOR.—John H. Walker, Walker's Landing, Tenn.—The invention consists in a machine whereby the peanuts and vines are thrust down an incline, caught by a revolving cylinder (whose teeth act in concert with those of a concave, to tear the vines to pieces and from the nuts), and transferred over an endless sieve to a reticulated cylinder, where the merchantable nuts are effectually separated from the vines and light nuts. By this machine, the nuts can be threshed, cleaned, and prepared for market, at a very small cost and with great economy in time.

WATER METER.—Edward Marsland, of Sing Sing, N. Y.—This invention relates to a new water meter, in which the water is conveyed in spiral jets against the recessed edge of a wheel, revolving the same in exact rat to the volume brought against it, and balancing it at the same time to reduce friction. The invention consists, principally, in the arrangement of the wheel and the chamber whence the water emanates, and also in the application of projecting wings or fans to the wheel and case, for regulating its motion and making it conform to the head of water.

COUNTERSINK.—Lewis H. Hunt, of Saxton's River, Vt.—This invention consists in the construction of countersinks for wood. It consists in constructing the tool of a solid shank and pad, and a detachable cutter fastened by a screw.

CIRCULATION VALVE.—Robert Pallett, of New York city.—This invention enables the man at the end of the hose of a fire engine or of the discharge pipe of a pump to shut off the discharge at any time without endangering the mechanism of the engine or pump, and without its being necessary to stop the pump. The construction is of such a nature that the increased pressure in the discharge pipe, consequent on shutting off the discharge, forces a plunger into a chamber fixed on the pipe. The movement of the plunger raises a valve which covers the mouth of a passage leading back into the receiver of the pump, and by these means the water is returned and circulated without danger to the pump or hose pipe.

DRAFT ATTACHMENT TO PLOWS.—Sylvester H. Dailey, of Olcott, N. Y.—This invention relates to a new draft attachment to plows, and consists in the application to the draft rod of a guide wheel which is self locking and serves in place of a clevis. The guide wheel runs in a strap which is suspended by sleeves loosely from the draft pin. When draft is applied, these sleeves are pulled forward, and notches in one of them are made to engage with projections from the draft pin; this locks the wheel strap in a vertical position. When turning corners, etc., the strap is unlocked by the action of a spiral spring which encloses the draft pin.

FERTILIZER.—James P. Crutchfield, of Fayette Corner, Tenn.—This invention furnishes an improved manure distributer of very simple construction. It consists of the box or body of an ordinary wagon, so arranged as to allow the manure to fall easily through holes in its bottom. The holes are provided with slides to regulate the quantity of manure released, and under each is suspended a spout to convey it to the furrow. The spout is made adjustable as to its angle of inclination, so as to let the manure pour out at whatever rate may be required.

DISH WASHER.—Safford D. Moxley, of Keeseville, N. Y.—This invention consists of any suitable tub, pail, or bucket, with vertical pumps on the opposite sides. There are two pumps by preference, although one would suffice, which have large openings at their bottoms. The piston rods extend upward through the tops, and are connected by bent bars with a rocking lever which is pivoted to the sides of the tub and provided with handles for working the pistons; by which means the water is alternately taken into the pumps and forced out again with great intensity, calculated to wash the dishes, vegetables, or other articles in the tub very quickly.

TOY PISTOL.—Benjamin Haviland and George P. Gunn, Herkimer, N. Y.—This invention relates to the construction of toy pistols, and consists in a peculiar arrangement of the air cylinder and its piston in the stock, combined with a charging rod, to depress the piston and charge the pistol.

PHOTOGRAPHIC LENS.—Richard Morrison, Brooklyn, E. D., assignor to Scovill Manufacturing Company, New York city.—In this improved lens, which is designed for a wide angle view lens, the front combination is composed of a plano-convex lens of plate glass, cemented to another plano-concave lens of flint glass, of such curves as to produce a combined lens sufficiently over corrected for actinic rays to properly correct the back combination, which is chromatic, and is composed of two lenses of plate glass, the first, or interior one, being a plano-convex, or double convex of the same focus as the second or exterior, which is a meniscus of nearly the same radiuses as the front combination.

CULTIVATOR.—Asa Bennett Springsteen, Schodack Landing, N. Y.—This invention furnishes a simple, convenient, and effective plow for cultivating corn and other crops planted in rows; it may be readily adjusted to scrape the soil toward or from the plants, as may be desired. It consists in attaching, adjustably, a surface scraper to the plow standard, which scraper is made triangular with its rear edge curved downward, so as to scrape the soil to one side. The scraper is followed by a leveler, also secured to the standard, which is provided with a downwardly projecting tooth. This stirs up the soil near the plants, and roots up any weeds, etc., that may be growing near them, and, also, smooths the surface.

THREE HORSE EQUALIZER.—Adam Lafayette Thomas, George James Thomas, and Thomas Newton Thomas, Lee's Summit, Mo.—This invention furnishes an improved three horse equalizer, and is so constructed that it may be readily adjusted so that the three horses may all have an equal amount to pull, or so that either the single horse or team may have the advantage, as may be desired; it consists in the arrangement of adjustable bars, which are pivoted to the tongue, and connected by chains so as to adapt them to receive the whiffletrees.

HAY ELEVATOR AND CARRIER.—John H. White, Columbus City, Iowa.—This invention relates to a new arrangement of carriage for elevating and conveying hay, straw, and other material for stacking or other purposes. The carriage runs, suspended by pulleys, on a rope stretched between two posts, and by means of various ingenious contrivances is made to take up its load in one spot, and to deposit it in another.

EARTH AUGER.—Xenophon Earle, Depere, Wis.—The boring part of this improved post hole auger consists of two scoops, which are shaped like half cones; they are connected by a scissors joint in such a manner that they may be securely shut together—thus completing the cone. When shut, one edge of each scoop projects beyond the opposing edge of the other, forming a cutter to dig into the earth, and leaving a space through which the dirt passes into the interior of the cone. The dirt is discharged by opening the cone. By this construction, the auger is readily and quickly forced into the ground, and when filled is drawn out easily, the dirt dug out by the auger being carried inward and packed into the cavity or space between the scoops, instead of being packed around the outer part of the bore or hole.

FEED WATER HEATER FOR STEAM BOILERS.—Joseph Rodgers, Clarington, Ohio.—This invention has for its object to economize fuel in the heating of water in steam boilers, and to insure a more thorough result from the heat.

TILTING MACHINE.—Bowen Mathews, Keyport, N. J.—The object of this invention is to furnish a machine for the amusement or exercise of children, invalids, and others, designed as a substitute for the rotating swing, etc., now in vogue. A couple of pulleys or rollers are attached to a ceiling or horizontal beam at some distance apart, and over them is passed a band, from each end of which is suspended a chair. The length of the band is adjustable. The chairs are made to rise and fall alternately by their occupants.

STALK CHOPPER.—This invention has for its object to furnish a simple, convenient, and effective machine for cutting or breaking up corn stalks and cotton stalks so that they may be conveniently turned under by the plow. It consists of a roller, made of any material possessing the requisite weight, which carries knives or cutting plates attached to its periphery, and is suspended, free to revolve, in the draft frame. By this construction, as the machine is drawn forward, the roller breaks down the dry stalks, and the knives cut or break them into pieces, longer or shorter, according to the distance apart of the knives, so that they will not interfere with the plowing.

SWITCH FOR PRINTING TELEGRAPHS.—Patrick Kenny, of New York city.—The object of this invention is to enable the operator, when working with several telegraphic printing instruments, to use them, one after another, without changing the different keys or using a separate battery for each. It consists in the employment of an electromagnetic switch instrument which is connected with the magnet and printing lever of each printing instrument in a manner to insure the following operation: As long as its printing lever is at rest, that printing instrument which is connected by metallic contact with the switch wheel of the switch has a current established through its magnet and can be worked in the usual way. Only one instrument at one time can be electrically connected with the switch wheel, as the springs belonging to the others are then resting on insulated portions of the wheel. Whenever the printing lever is raised, the circuit through the printing magnet is interrupted and metallic connection with the magnet of the switch is made. This enables the operator to establish, by touching an appropriate key, a current through the switch magnet which causes the switch wheel to rotate and brings the spring belonging to another printing instrument into metallic contact with it, while it breaks contact with the first. The key of the switch magnet is touched as often as is necessary to bring the right instrument into circuit, supposing more than two are connected with it. If, during the elevation of the printing lever, the key is not touched, the printing instrument connected with it will be in circuit on its descent.

TUG BUCKLE.—James C. Barrows, of Centerville, Iowa.—This invention furnishes an improved tug buckle, which does not wedge the tug so as to injure it; and which is easily adjusted and effective in operation. It consists of an ingenious arrangement of various parts which could not be explained without drawings.

MACHINE FOR FINISHING DRAIN TILES.—Andrew L. Brown, of London, Ohio.—This invention furnishes an improved machine for beveling one end and recessing the other end of lengths of drain tiles so as to form a joint. Its principal features are: An automatic carrier which receives the tile, holds it while its ends are operated on, and disharges it when finished; and the leveling apparatus, which consists of two wire cutters, set parallel with each other, and carried on two movable shafts between which the tile is placed to have its ends cut.

SEED PLANTER.—Augustus Richards, of Anderson, Texas.—This invention furnishes a simple, convenient, and reliable machine for planting corn, cotton seed, and other seeds, which is so constructed that it may be conveniently adjusted to plant less or more seed, as may be desired. The seed dropper is barrel shaped and is carried between the wheels of the machine. It has a band around its center which is pierced with discharge holes through which the seeds fall to the ground. These discharge holes are shut or opened by slides which are adjusted so as to regulate to a nicety the quantity of seed dropped. There are a furrowing plow and other attachments, which we have not space to describe.

ELEVATOR.—Alfred B. Darling and James Bones, of New York city.—The object of this improvement is to prevent the falling of the elevator platform in case of the breakage of the main lifting rope. This is accomplished by an ingenious arrangement of various devices.

SEWING MACHINE CASE.—Gustav Heckel, of Belleville, Ill.—This invention furnishes an improved sewing machine case and table. The case consists of a back piece, which is hinged within a slot along the rear side of the table, and a front piece, connected by a flexible top. The two sides are hinged to the back piece. When closed, the sides form a support for the flexible top. A prominent feature of the invention is an adjustable piece which fills in the slot behind the hinged back so as to preserve the symmetry of the table when the case is closed.

WATER METER.—Hezekiah Olney, of New York city, assignor to himself and Lucius R. Townsend, of Malone, N. Y.—This invention consists in making the meter in two compartments, one for receiving, the other for discharging the liquid, so that from the latter vessel the water may flow continuously. The water flows through a pipe into the receiving compartment and, on filling the same to a certain hight, raises a float which operates a valve attached to the pipe. The movement of the valve shuts off the flow of water into the receiving compartment and, at the same time, opens a channel between that and the discharging compartment. When the water has passed from one compartment to the other, the float falls and the operation is repeated. Other devices are connected with the apparatus, which space prevents us describing in detail.

FENCE.—Andrew A. Garver, of Albion, Iowa.—This invention consists mainly in arranging the cross slats of the panel diagonal to the rails of the same to admit of a better connection of the panel with the double brace than in other portable fences. The fence consists of panels composed of rails connected together by upright slats placed in an inclined position, so that the upper rail will project six inches, more or less. The lower ends of the slats project down below the lower rail. In the lower edge of the lower rail are notches, just inside of the uprights. These notches and the arrangement of the slats allow the upper and the lower rails of the panel to engage with the brace of the fence.

DAMPER FOR FIRE PLACE.—Joseph Bridgham, of New York city.—This invention relates to a new damper for fire places, to be used in chimneys above grates for regulating the draft. It consists in providing the damper with projecting pivot pins and stops at the ends, and in the use of metallic sockets for its support built into the wall.

PACKING.—George Tetley and Charles D. B. Fisk, of Providence, R. I.—This invention relates to an improvement in metallic packing for piston and valve rods, and for all similar purposes. The packing is made in sections; each section consisting of two parts, which are made to fit each other and the rod they enclose. The sections are laid one above the other, reversing the position of the two parts in each alternate section, and are kept pressed against the rod by two springs placed between them and the ox. The boxes may be circular, rectangular, or of other form.

BALLASTING VESSELS IN PORT.—Francesco Demartini and John Chertizza, of Brooklyn, N. Y.—Under the present practice, when a vessel arrives in port and discharges her cargo, ballast must be immediately taken in to prevent careening and consequent injury to herself or other crafts. To avoid the loss of time and expense attending this course, this invention employs ballast logs, connected with the vessel by ropes or chains, that lie alongside and float in the water. The logs are not intended to hold the vessel down in the water, but merely to act as counter or balance weights when she attempts to keel over from any cause.

STOVE PIPE FITTER.—William Volk, of Buffalo, N. Y.—The object of this invention is to provide a simple, durable, and effective device for fitting stove pipes together, as, for instance, where the two parts are of the same size, or where bruised or out of shape. It consists of a frame which has two jaws, with lugs for two levers. One jaw is corrugated or serrated, and the other is smooth. Each jaw is provided with a lever of corresponding form, confined by fulcrum pins to the lugs. By the application of the serrated jaw and lever to the pipe, the latter is made to partake of the form of the jaw, and its end is consequently reduced in diameter. When the other jaw and lever are applied, the tendency is to expand and smooth out the pipe. When the two parts of the pipe are operated upon in this manner—that is, one corrugated or serrated, and the other expanded—they will fit together and may be joined without difficulty.

SAND AND GRAVEL SEPARATING MACHINE.—Nicholas J. Keller, of East Birmingham, Pa.—This invention relates to a new machine for separating sand and gravel or other materials from the matter elevated by dredging machines. The framework of the machine is coupled by a dredge boat or dredging apparatus, from which an endless chain or apron extends over one end of the separator. This apron or chain conveys in its buckets all the matter raised by the dredge on to an inclined sieve or perforated spout, which is securely fixed at one end of the frame. Water is conveyed to the spout by another endless chain or apron, and serves to so loosen the mud that all gravel and sand passes through, but all other matter is discharged. What passes through the sieve is carried toward the inner part of the separator into the higher end of an inclined perforated cylinder. This cylinder, being covered with wire screen and revolved by suitable mechanism, separates the sand and gravel by letting the sand pass through its finer meshes into a box, and the gravel through the larger meshes at the lower part into another receptacle. All extraneous matter or refuse is discharged overboard through the lower end of the cylinder, which is open.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)
From May 14 to May 20, 1872, inclusive.

CAR COUPLING.—C. L. Horack, Winona, Minn.
ELECTRIC SIGNALS.—E. A. Calahaw, of Brooklyn, N. Y., London, Eng.
FOUL AIR TRAP.—J. Daniels, Washington, D. C.
HUB.—W. Lyman, East Hampton, Mass.
MAGIC LANTERN.—L. J. Marcy, Philadelphia, Pa.
MAKING PINS.—T. B. De Forest, of Birmingham, Conn., London, Eng.
PAPERING PINS.—T. B. De Forest, of Birmingham, Conn., London, Eng.
PAVING BLOCKS, ETC.—F. A. Luckenbach, New York city.
PIANOFORTE.—C. F. T. Steinway, New York city.
PROJECTILES, ETC.—J. G. Butler, Fortress Monroe, Va.
PROPELLING SHIPS.—L. B. Bruen, New York city.
SEAT AND DESK.—H. W. Curtis, New York city.
SEEDING FRUIT.—G. L. Taylor, D. Holland, Springfield, Mass.
SHEET IRON.—W. Rogers, Apollo, T. J. Burchfield, Allegheny, Pa.
SHOEMAKING MACHINERY.—W. J. B. Mills, Philadelphia, Pa., D. W. C. Taylor, Elizabeth, N. J.
SLIDE VALVE.—G. Westinghouse, Jr., of Pittsburgh, Pa., London, Eng.
STEEL.—T. Brooks, Minerva, Ohio.
TIMEKEEPER.—H. B. James, Trenton, N. J.
VEHICLE FOR PAINTING.—E. Densmore, New York city.
WOOD CUTTING MACHINERY.—J. Richards, Philadelphia, Pa.

FOREIGN PATENTS---A HINT TO PATENTEES.

It is generally much better to apply for foreign patents simultaneously with the application in the United States. If this cannot be conveniently done, as little time as possible should be lost after the patent is issued, as the laws in some foreign countries allow patents to any who first make the application, and in this way many inventors are deprived of valid patents for their own inventions. It should also be borne in mind that a patent is issued in England to the first *introducer*, without regard to the rights of the *real* inventor; therefore, it is important that all applications should be entrusted to responsible agents in this country, who can assure parties that their valuable inventions will not be misappropriated. The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address

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20,249.—HULLING AND THRASHING MACHINE.—John C. Birdsell.
20,267.—THICK WOVEN FABRICS.—J. Gujer.
20,313.—DEVICE FOR SQUARING AND MARKING.—H. Smith.
20,306.—AFFIXING POST OFFICE STAMPS.—G. K. Snow.
20,277.—GRINDING AND SIZING PAPER PULP.—J. Jordan, Jr., T. Eustice.

DISCLAIMERS.

39,779.—E. C. Wooster, New York city.
65,184.—W. C. Durant, W. Buswell, West Troy, A. Brown, Troy, N. Y.

DESIGNS PATENTED.

5,876.—TABLE SPOON.—B. D. Belderhase, New York city.
5,877.—PICTURE FRAME.—J. J. Gray, Boston, Mass.
5,878 to 5,880.—CARPETS.—A. Heald, Philadelphia, Pa.
5,881.—FLOOR CLOTH.—A. Heald, Philadelphia, Pa.
5,882.—STOVE FRONT.—G. Smith, H. Brown, Philadelphia, Pa.

TRADE MARKS REGISTERED.

833.—CARD STOCK, ETC.—Bergen & Bainbridge, New York city.
834 and 835.—WOVEN GOODS.—M. Landenberger & Co., Philadelphia, Pa.
836.—BANK CHECK DETECTOR.—J. W. McKeanan, Philadelphia, Pa.
837.—VACCINE.—J. Milhau's Sons, New York city.
838.—INJECTING SYRINGE.—W. Molesworth, New York city.
839.—COTTON SHEETING, ETC.—Paton & Co., New York city.
840.—AXES.—The Underhill Edge Tool Company, Nashua, N. H.
841.—BITTERS.—J. T. Webber & Co, Springfield, Mass.
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DESIGNS PATENTED.

5,883.—CARPET.—M. Blatchford, Halifax, England.
5,884 to 5,890.—CARPETS.—A. Cowell, Kidderminster, England.
5,891.—CARPET.—J. Humphries, Kidderminster, England.
5,892.—CLOCK CASE.—Nicholas Müller, New York city.
5,853 to 5,896.—CARPETS.—D. Paton, Halifax, England.
5,897.—CARPET.—F. J. Peirce, Boston, Mass.
5,898 and 5,899.—CARPETS.—E. Poole, Halifax, England.
5,900.—GLASSWARE.—J. S. and T. B. Atterbury, Birmingham, Pa.
5,901.—HEATING STOVE.—C. H. Castle, Quincy, Ill.
5,902 to 5,904.—CARPETS.—J. Humphries, Kidderminster, England.
5,905.—CARPET.—A. McCallum, Halifax, England.
5,906 and 5,907.—FLOOR CLOTHS.—C. T. and V. E. Meyer, Lyon's Farms, N. J.
5,908 and 5,909.—CARPETS.—E. Poole, Halifax, England.
5,910.—CARPET.—E. J. Ney, New York city.

TRADE MARKS REGISTERED.

843.—SCYTHES.—Beardsley Scythe Company, West Winsted, Conn.
844.—OVERSHOES.—E. F. Bickford, Malden, Mass.
845 and 846.—BITTERS.—H. S. Flint & Co., Providence, R. I.
847.—LEAD.—Forest River Lead Company, Salem, Mass.
848.—TAMARIND BEER.—W. H. Goss, Boston, Mass.
849 and 850.—EDGE TOOLS, ETC.—The Collins Company, Collinsville, Conn.
851.—STATIONERY.—Mercantile Loan and Warehouse Co., New York city.

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending, for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

21,240.—LATHES FOR TURNING BEADED WORK.—F. Baldwin. August 7, 1872.
21,372.—FARE BOX FOR OMNIBUSES, ETC.—J. B. Slawson. August 14, 1872.
21,464.—MANUFACTURE OF BRUSHES.—Stephen Barnes. August 21, 1872.
21,574.—PREVENTING NUTS FROM UNSCREWING.—Samuel Noblet. Sept. 4, 1872.
21,749.—CROSS SEAMING SHEET METAL.—Lucian Fay. Sept. 25, 1872.
21,268.—HORSE RAKES.—M. Morgan. August 7, 1872.
21,306.—HILL SIDE PLOW.—H. S. Akins. August 14, 1872.
21,334.—SUN SHADE.—A. G. Davis. August 14, 1872.
21,367.—CARRIER OF THRASHING MACHINE.—F. W. Robinson. August 14, 1872.
21,291.—PROP OF CARRIAGE BOW.—D. B. Wright, L. Sawyer. August 14, 1872.
21,540.—APPARATUS FOR HARVESTERS.—A. Sherwood. August 28, 1872.

EXTENSIONS GRANTED.

20,314.—VALVE COCK.—S. Adams.
20,327.—LEVELING DEVICE.—H. Disston, T. L. Morse.
20,353.—ELECTROTYPE PLATES.—S. P. Knight.
20,356.—PROTRACTOR.—J. Lyman.
20,364.—CLOTHES PIN.—D. Pierce.
20,385.—POWER AND HAND DRILL.—H. Woodman.

EXTENSION REFUSED.

20,411.—RAKING ATTACHMENT TO HARVESTER.—D. O. De Wolf.

DISCLAIMER.

LOOMS AND FABRICS.—W. Smith, New York city.

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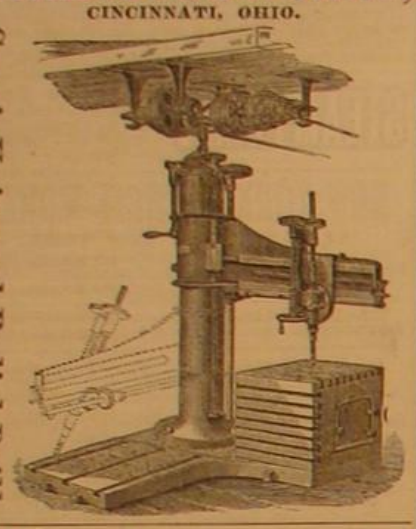

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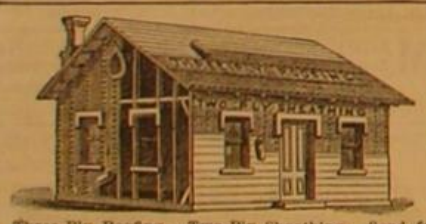

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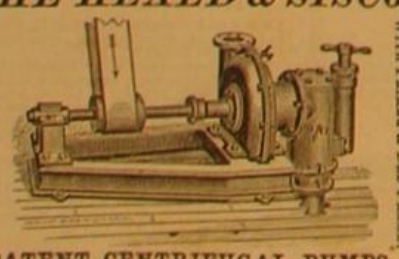

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SCIENTIFIC AMERICAN

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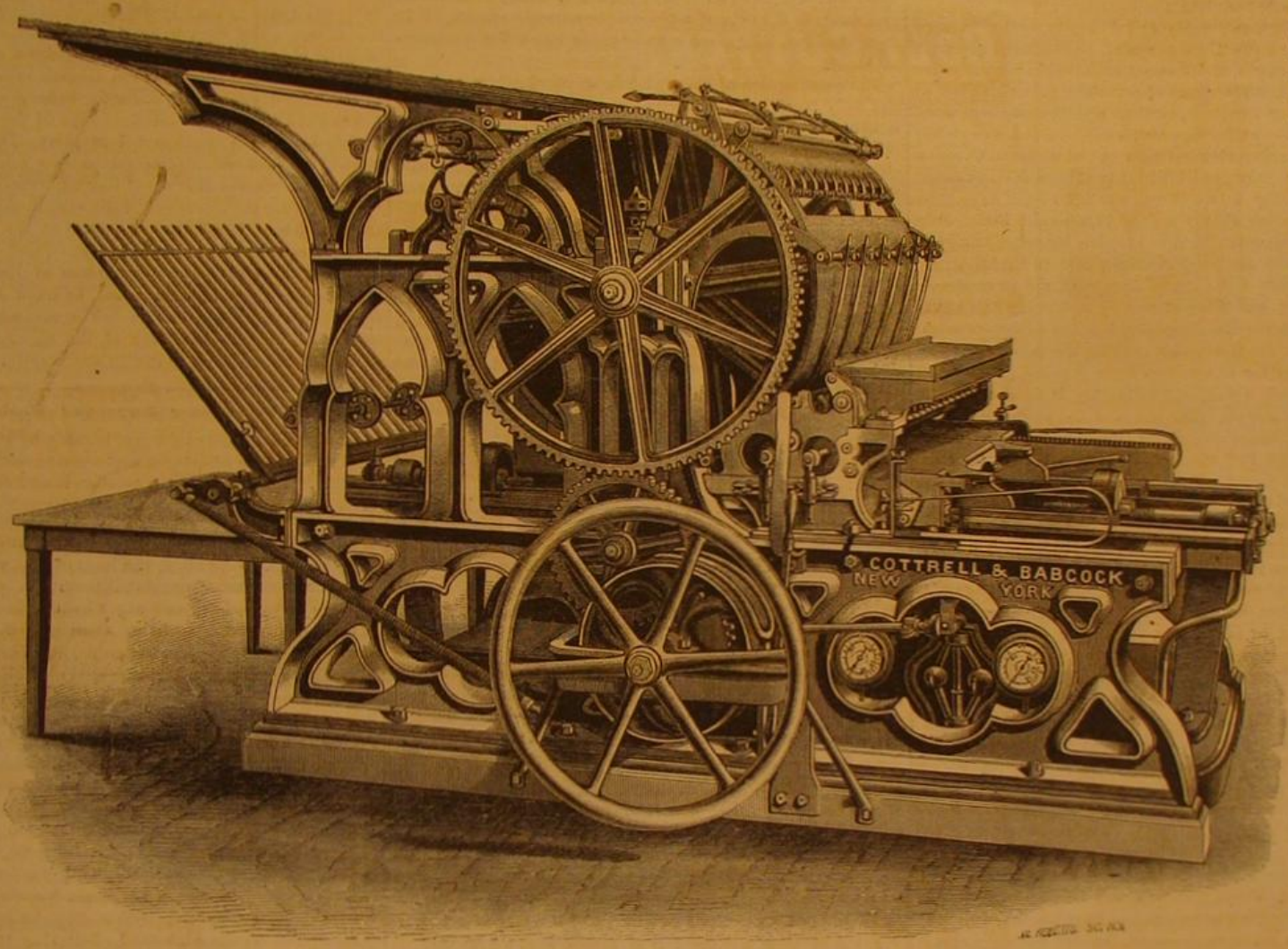
Air Spring Printing Press.

The old maxim, that "time is money," has never been better exemplified, perhaps, than in the multitude of efforts that have been made, in a variety of devices, to increase the speed of the flat bed cylinder printing press. To achieve this desideratum, it is of the greatest importance that the best system of resistance be employed to overcome the momentum of the bed of the press when in rapid motion. Wire springs have been tried but were found wanting, although for many years they have been employed almost exclusively.

Compressed air, however, has been for a long time universally acknowledged to be the best spring for that purpose, and it is our province here to show some important improvements which have lately been made in its construction.

The air spring heretofore in use was made with a solid or non-yielding plunger which caused much inconvenience and not infrequent damage, by carrying into the air chamber any sheet, tape, etc., that might accidentally have dropped on it. This was attended by the instant stoppage of the press, and vexatious delay and difficulty were incurred in forcing the plunger and its incumbrance from the air chamber; sometimes fracture of the bed and destruction of gearing took place. With the old wire spring, if enough pressure were exerted by it to properly overcome the momentum of the bed, it would be impossible to help it over the centers by hand and start the press; we may therefore infer that the resistance actually offered by it was never sufficient for the requirements of the press. In running at different speeds, the spring should be regulated to accord with them, which, in the old springs, could not be done with any certainty; and while the press is at rest, it is desirable that the spring should be inoperative, as without springs there are no centers. It now remains to describe the improvements and see how they meet the case presented.



COTTRELL & BABCOCK'S AIR SPRING PRINTING PRESS.

The accompanying engraving (Fig. 1) represents a press supplied with the improved spring. The bed is provided with two cylinders to engage with the plungers seen at the ends of the frame, and the hollow rods of these plungers are connected by a pipe running along the lower part of the frame; which pipe is opened or closed by the valve of the governor shown through the opening in the framework.

Fig. 2 represents a cross section of the plunger, A, which, it will be seen from the engraving, is arranged with springs so as to allow the outside packing to contract and expand; it thereby obviates, the inventor says, all difficulty arising from paper, tapes, or other matter falling on the plunger while the press is in motion. Fig. 3 shows a longitudinal section of the plunger, A, its hollow rod, and an automatic valve, B, at its extremity. This valve rises on the return motion of the bed and prevents a vacuum forming in the cylinder, whereby all strain or drag is prevented and power saved.

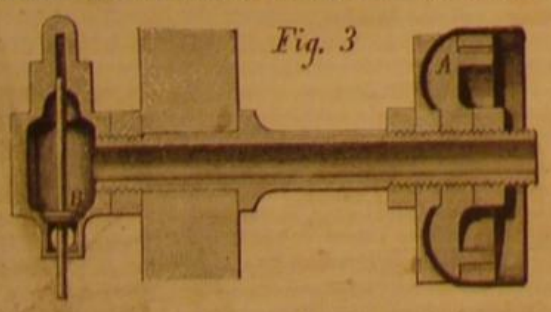


Fig. 3

Fig. 2

Fig. 4 represents the governor attached to the connecting pipe, with the plug valve, C, which it operates, and two spring gages to indicate the amount of condensation in the cylinders. The valve is shut by the motion of the press when running at speed, and is, of course, open when the press is at rest. This enables the press to be started at any point without helping it over the centers by hand. The spring gages perform an important function. As they indicate the pressure in the air cylinders, and as this is determined by setting the plungers backward or forward on their rods, there is no difficulty whatever in exactly adjusting the amount of spring to the speed of the press. Every press is furnished with a table showing the gage pressures, indicating the amount of spring required for the different speeds run. All the workman has to do is to adjust the plungers until the gages indicate the pressure laid down in the table.

As compared with the wire spring, it is stated, this spring admits of the press being run quite 25 per cent faster, and without the wear, consequent on the strain caused by the wire spring, and the accompanying jar and noise.

Patents were obtained through the Scientific American Patent Agency, May 2, October 17, and December 12, 1871, for the inventor, Mr. C. B. Cottrell, of No. 8, Spruce street, New York city. Further information may be obtained of Messrs. Cottrell & Babcock, at the above address, by whom the improved press is extensively manufactured.

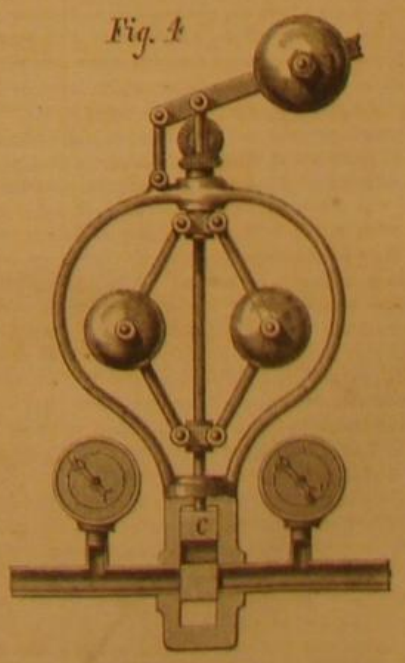
NOVEL MODE OF SAWING WOOD WITHOUT A SAW.

The dominion so long held unquestioned by ax and saw has been at length invaded. Electricity has been pressed into the service and threatens to drive these implements into banishment; while the muscular and other forces which were so largely expended in their use are replaced by the action of the galvanic battery in one of its most simple forms.

The invention we are about to describe, and which was patented through the Scientific American Patent Agency, on the 28th of last May, is that of George Robinson, M. D., of this city.

That gentleman was well aware that a galvanic current in sufficient quantity, when passed over fine platinum wire, would raise its temperature to a red or even white heat. The most important application of the principle had previously lain in the employment of the heated wire in certain surgical operations as a substitute for the knife or red hot iron. It was found that the red hot wire easily cut or rather burnt its way, through the living flesh, and tumors of considerable size were thus removed from the human body. The inventor's attention being fixed on the fact that sodden, wet flesh was cut through in this way, a little reflection satisfied him that the division of wood, a comparatively dry substance even when green, could be more readily effected by the electrically heated wire.

Fig. 4



This proved to be the case, and on gently pressing pieces of wood against the red hot platinum wire, especially when aided by a slight sawing movement, the wood was divided in any required direction as by a handsaw, and, of course, without any effort of skill or appreciable expenditure of muscular power. By arranging the wire with handles or other means, so as to guide it readily, the lumber, whether in trees, logs, or planks may be cut easily as desired. There is here, therefore, a simple and easily applied force, which, in a child's hands, may be employed to fell trees, divide them into logs, and, in short, perform all the operations of the saw and the ax. The surface of the wood where thus divided is, of course, slightly charred, but the black layer is very thin, and for many purposes not disadvantageous, as it is known to preserve timber. The battery employed need only be of the simplest character, as quantity, and not intensity, of current is required.*

THE KAOLIN OF THE UNITED STATES.

Dr. Lewis Feuchtwanger recently read, before the Polytechnic branch of the American Institute, a paper on this subject, from which we take the following:

The china clay, commonly called kaolin, occurs in very large deposits in the United States, particularly in South Carolina and Georgia, and its production offers remunerative results for the manufacturers of porcelain, manufacturers of paper and paper hangings, earthen and Rockingham ware, paint manufacturers, frame makers, molders, and many other artisans. The paper clay has been mined in South Carolina for a number of years, and brought to this market, where it always finds ready sale. More than 3,000 tuns have been landed here during this year, and 10,000 more are already engaged to be delivered for the extensive branches just mentioned. But there are many more deposits in that State capable of producing a million of tuns with the most simple *modus operandi*, consisting of cutting or digging the white clay, which is either directly exposed on the surface or within a few feet of the alluvial soil, drying the lumps by exposure to the sun for one or two days, packing into tierces holding about half a tun, and delivering it to the railroad within a mile of the pit. The range of the sand hills in the above States, which contain those extensive clay deposits, is, in a geological point of view, of great importance, for they are all usually found adjacent to the rivers, and more developed near the larger streams than the smaller ones; the sand hills appear to be accumulations of sand, produced by aqueous agency, during the period when the lower boundary of the primitive region constituted an ancient sea beach. The clay strata of various thicknesses are generally considered, by geologists, as the results of decomposition of the felspathic rocks, or of felspar, forming a component part of the granitic and gneissoid rocks of the azoic period during their alteration in the cenozoic time by means of Plutonic agency; while the sand hill formations arising from the decomposition of the tertiary and post tertiary rocks, and including the pleocine, miocene, and eocene formation, took place under Neptunic auspices, as the specimens exhibited, gathered in the sand hill regions, clearly prove. The granite is known everywhere to underlie the marl and clay beds, and we find the same phenomena over an extent of 1,500 miles, beginning in Vermont, crossing over to New York, forming large deposits in New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North and South Carolina, and Georgia. Further, while examining, in Alabama, the triassic rocks of the cretaceous period, we are fully convinced that the great supply of organic remains, the mineral composition and its interposition, prove their true position to be in the geological periods just mentioned.

It is a very remarkable fact that the white clay deposits are mostly found near the surface of the earth. But still more remarkable is the existence of those large clay deposits, so perfectly free from foreign admixture, and even of remains of the felspar from which it originated. Analysis of an orthoclase shows a composition of 65 silica, 17 alumina, 3 soda, 9 potash, and 1 water, while albite and oligoclase have about the same composition, with certain differences in the bases. None of the felspar contains over one per cent of water, while the analysis of the white clay from South Carolina shows the presence of 12 per cent water, and not a trace of potash or soda, and only 2 per cent lime and magnesia, and the silica and alumina in about equal proportion, namely, 44 per cent silica and 39 per cent alumina. In its physical character, the alteration is just as remarkable. Neither mica nor quartz can be detected by the eye or the touch. New Jersey clays and the English china clay have the same peculiarity, as proved by their analysis, and a grave question arises how this metamorphosis took place, and where have the alkalies of the pre-existing felspar gone, and how have they disappeared and been replaced by water? In looking among the elements for an agency, we find carbonic acid the only element that could have produced this metamorphosis: but we are puzzled to know by what process and at what period of decomposition such a change has taken place.

The white clay of South Carolina appears to be fully equal in quality to the famous English china clay, which is largely imported from Cornwall, England, and so extensively used in the arts. But there it is not found in such large masses as in South Carolina, where the writer examined a number of deposits of acres in extent, and from five to ten feet in depth. Since one yard square yields 300 cwts. of the fine and pure clay, the supply is inexhaustible. The peculiar appearance of a thin crust covering the sand hills is, to the observer, of great interest; for it gives undeniable proof that the transformation of the metamorphic or crystalline rocks, during the azoic period, took place under volcanic auspices, and that the result of the decomposition must have undergone several other alterations before the present condition of the sand and clay was attained.

A ferruginous sandstone, resembling fused masses from a great heat, and assuming thin crusts with fantastical figures, is seen all along the sand hills, just below the alluvial soil, and above the sand and clay hills, and I have seen the same crusts of oxide of iron on the railroad from Washington to Baltimore, lying over the sand strata in that neighborhood.

In Georgia, within the compass of the Blue Ridge, extensive deposits of blue or fire clay, resembling the New Jersey blue clay, are found, which are accompanied by a brown mineral, resembling amber, but properly a brown lignite, which, when freshly broken, has the odor of petroleum; and also accompanied by large quantities of oyster (*gryphea*) shells and other forms.

The burrstone or millstone grit is also found contiguous to the clay beds, or at the sand hills, where I found a large mass of several hundred pounds, composed all of silicious shells within the red sand strata.

A beautiful sandstone with oxide of manganese in black spots, and which is sometimes called leopardite, from its resemblance to the skin of a leopard, is here presented. It is from the Blue Ridge, and may be made into a fine ornamental stone.

The consumption of china clay or white clay is very large and daily increasing; statistics show that during the last six months about 2,000 tuns of English clay have been imported in this port. South Carolina has furnished for the paper makers and stainers in New York, Boston, Philadelphia, and Baltimore 2,000 tuns during the same period. The Trenton (N. J.) potteries consume 20,000 tuns per annum. The Ohio potteries in Liverpool and Cincinnati consume annually over 40,000 tuns. The price of the English clay averages $30 gold per tun, while the American can be had for a little over half that price in currency.

In the following analyses of the English china clay, Stourbridge and German clays, and that from South Carolina, New Jersey, and Missouri, we shall see that the Southern clay is in every respect equal to the Cornwall clay so largely imported into the United States:

English best white clay, washed.		South Carolina white clay, unwashed.	
Silica	46·32	Silica	44·46
Alumina	39·74	Alumina	39·82
Lime	0·56	Lime and magnesia	1·06
Magnesia	0·44	Oxide of iron	0·60
Protoxide of iron	0·27	Titanic acid	0·94
Water	12·50	Water	12·10
South Amboy (N. J.) white clay, unwashed.			
Silica	43·21	Water	14·25
Alumina	39·71	Potash, zirconium, and iron	2·83
English Stourbridge clay for glass pots.		German clay for pots.	
Silica	65·10	Silica	50·20
Alumina	22·22	Alumina	34·13
Potash	0·18	Potash	0·29
Lime	0·14	Lime	0·30
Magnesia	0·18	Protoxide of iron	·31
Protoxide of iron	1·32	Water	13·70
Phosphoric acid	·06		
Water	9 86		

Chemical Action of Light.

Professor Roscoe lately delivered the first of four lectures at the Royal Institution on the "Chemical Action of Light." He began by showing how a chemical change in certain gases, liquids, and some few solids will change their colors and their action upon waves of white light. He said that sometimes an approximation or separation of particles may be set up by mechanical means, as in the case of a mixture of chlorate of potash and sulphur, which gives a series of loud snaps when a little of it is struck with a hammer. It is dangerous to detonate this mixture in any but small quantities. Heat also will cause explosions in some cases; for instance, when a flame is applied to a mixture of oxygen and hydrogen gases. In like manner light, in some instances, has the power of promoting the approximation or separation of particles. The effect of light on various bodies is by no means the same, and its action on chemical substances can be mechanically explained by the aid of the law of the conservation of energy—the energy of the interstellar ether is expended in acting upon the substance molecularly changed.

As an example of a chemical change which could be produced by light, he placed a mixture of oxygen and chlorine enclosed in a very thin glass bulb, inside a cylinder of thick glass. The bulb had been filled in the dark, and kept in a dark box until required for the experiment. Then he placed a glass trough full of water behind the cylinder, and burnt some magnesium on the other side of the glass trough so that the rays of light had to pass through the water to get at the bulb. The light caused the mixed gases in the bulb to explode; it was not the heat of the flame which caused the explosion, because the water sifted out all the heat rays, with exception of the very small proportion contained in the visible rays from luminous sources. He said that green light will very slowly decompose a mixture of chlorine and hydrogen; the power of decomposition increases as the violet end of the spectrum is approached. Strangely enough, there are two points of maximum action in the chemical part of the spectrum, and between these two points the rays have less chemical action on the mixture.

Professor Roscoe next told how the action of light upon salts of silver gave rise to the beautiful and wonderful phenomena of photography. Although this chemical action of light was noticed as early as the sixteenth century, it was not until 1777 that the Swedish chemist, Scheele, explained the philosophy of it, and pointed out that the hydrochloric acid was set free, leaving a black deposit of finely divided silver; he first proved that the action took place in the blue and not in the red portion of the solar spectrum. The lecturer then proved by experiment that chloride of silver was blackened by the blue and not by the red rays.

He said that the decomposition of carbonic acid under the influence of sunlight, by the green coloring matter of leaves, was another example of the chemical changes sometimes produced by light. The earliest experiments on this subject were made by Priestley in 1790. This acute reasoner proved by experiment that it was only in the presence of sunlight that the evolution of oxygen from plants takes place. He took a large inverted vessel full of water charged with carbonic acid and placed a living plant inside; then, in the presence of sunlight, bubbles began to form on the leaves of the plant, then to rise to the top of the vessel. On examination the gas thus produced was found to be pure oxygen. Priestley took a candle and burnt it in a closed volume of air under a bell-jar, until the candle went out after consuming most of the oxygen and liberating carbonic acid. He next placed a fragment of a growing plant in the jar and exposed it to sunlight; in course of time the air was rendered pure again, so that another candle could be burnt in it, and the experiment repeated over and over again an indefinite number of times. Professor Roscoe proved this by showing that a taper would burn brightly in a glass jar containing growing musk, though when the musk was first put in the jar, the air had been made so impure by the burning of a candle in the glass vessel that it would not then support combustion. Priestly tried many of his experiments with mint, and not a few of them with other vegetables; he found spinach to be most effectual in restoring oxygen to air under the influence of light.

The existence of the ultra red rays of the spectrum was first demonstrated by Herschel in 1800. The existence of ultra-violet rays was demonstrated later still by Wollaston and others. It was discovered that chloride of silver became blackened beyond the range of the visible rays of the spectrum. It was found that the lines of the chemical part of the spectrum could be photographed, and that the photographs of them, taken by Rutherfurd of New York, agree with the drawings of them made by hand by Kirchoff, although in a few cases they do not agree in breadth and in intensity. The chemical rays of the spectrum differ from each other solely in wave length and amplitude of vibration

$10,000 Reward for Improved Railway Signals.

An offer of the above amount is made by parties in Boston for the invention of devices that some of our ingenious readers can certainly supply. The offer is as follows:

To the Editors of the Boston Daily Advertiser:

There are in the United States several millions of persons, sick and well, living along the lines of the various railroads and near manufacturing establishments in populous towns, who are disturbed day and night by the discordant shrieks of the modern steam whistle. Owing to the gradual introduction of this apparatus, the public has learned to tolerate it, but we venture to assert that if it could have been introduced suddenly as we hear it to day, no community would have consented to its use. These unearthly sounds are made in manufactories at early dawn, at noon and at night, to call their operatives to work and to meals, and on the railroads to warn passengers on the highways, and to give notice to switch tenders on the approach of trains. It is not necessary to describe them, since they are familiar to all, and all are more or less affected by them. Is there no remedy for this increasing evil, or cannot a substitute be found which will answer all the purposes of the steam whistle, without annoyance to the public, and with safety to travellers on the railroad and on the highway? Believing that such a substitute can be found, and to encourage experiments in that direction, we hereby agree to pay the sum of ten thousand dollars to any one who shall, within two years from January 1, 1873, invent a system of signals which shall supplant the use of steam whistles on railroads, and which shall be pronounced by judges, hereinafter named, to be free from the evils of the present system, and which shall be attended with no discomfort to passengers on the trains, or the highways, or to residents along the line of the railroads. One fifth of the amount thus pledged shall be paid to the author of such invention at any time within the period specified, whenever its claims shall be substantiated by the said judges, and the balance whenever the invention shall be adopted and used by a majority of the railroad companies in New England, provided such adoption be previous to January 1, 1877. The judges in these premises shall be the Chairman of the Massachusetts board of railroad commissioners, the President of the Boston and Albany and Boston and Maine railroad corporations, the Professor of civil engineering in the Massachusetts Institute of Technology, and the chief locomotive engineer on the Boston and Albany railroad. If any of the above named gentlemen shall decline to serve as judges, the donors reserve to themselves the right of naming substitutes.

Communications may be addressed to "Committee on Railroad Improvements," care of *Boston Daily Advertiser*, Boston, Mass.

The Brewing Interests of the United States.

The twelfth annual convention of the chief association of the brewers of the United States was recently held in this city. From the opening speech of the President, Mr. Henry Clausen, we learn that there are at present three thousand breweries in the country, employing a capital of over one hundred million dollars and giving employment to thousands of people. The trade yearly consumes twenty-three million bushels of barley and over eighteen million pounds of hops. The revenue derived by the United States from this industry amounted in 1871 to seven millions eight hundred thousand dollars, being an increase of over six million dollars since 1863.

PORTABLE FRESCOES.

The process of frescoing in oils, invented by Mr. Charles T. Kemmer, is a novelty in its way, and, we think, is likely to entirely supersede the ordinary mode of frescoing. It is designed to do away with the expense and inconvenience always attendant on the usual processes, and, at the same time, to furnish artistic decorations of a most superior quality and durability.

We may describe the process briefly, as follows: Ordinary sheeting is dipped in soap and water and stretched upon a frame; it is afterward covered with a coating of gelatinous size, and allowed to dry. An oil painting of the nature required is then executed on the prepared sheet, and, after it is thoroughly dried, the gelatinous sizing between it and the sheeting is moistened, and the painting removed, bodily, from the sheeting. The painting is then attached to the plaster by a liquid cement of appropriate character.

In the production of the painting, whether it be merely a plain tint, an ornamental design, or a gilded decoration, about five coats of the best linseed oil fresco paint are used. This produces a tough, tangible film, about the thickness of good writing paper, which will bear washing with soap and water and a sponge as often as may be desired. When cemented to the plaster, it adheres with a tenacity entirely unknown where the paints are laid directly on, as in ordinary frescoes, which are liable to peel off. Cracks occurring in the plaster do not affect the film unless they are of large size.

In the manufacture of this portable fresco, plain tints, etc., are turned out in pieces 20 inches wide and 8 yards long, ready for attachment to the plaster. Where a ceiling or wall is to be covered with a decoration specially designed for the purpose and complete in itself, the painting is executed of the size required, and the film is cut into strips of a convenient size for cementing to the plaster: as the strips are cuttings from one piece, they of course match so accurately that no join is discoverable.

Among the advantages belonging to this process are the facility with which frescoes for distant use may be designed and painted, and the very short time which is necessary to fix them on the walls or ceiling after they are done. As an illustration of the latter, we may state that the film can be applied in one day to a ceiling which it would take three weeks to fresco in oil in the regular manner.

Mr. Kemmer has received patents for his invention both in this country and in Europe. Further information may be obtained by addressing Charles T. Kemmer & Co., Passaic avenue, East Newark, N. J., or at No 4 Warren st, New York.

A Recent Tornado.

Portions of our Western prairie country, by their comparatively level and unobstructed formations, present a fine field for the play of the winds, and for the formation of those remarkable spiral currents known as whirlwinds, from which great damage sometimes results. These spiral currents usually cover a very narrow pathway on the surface of the ground, but they operate with tremendous force, and might not inaptly be termed pneumatic plowshares. One of these aerial giants made its appearance at Quincy, Logan county, Ohio, on the 8th of June.

A sultry day was followed by the appearance of a cloud, in the West at 5 o'clock in the evening, which increased in blackness and size with fearful rapidity. A heavy wind soon set in, and at 5.30 o'clock the whirlwind struck the earth five miles from Quincy, moving in a northwesterly direction. The tornado reached Quincy in about five minutes and passed through the town, making a clean sweep of houses, trees and fences along a path which fortunately was comparatively narrow. In this village 50 or 60 dwellings and stores, two churches, and as many more shops, stables and outbuildings were unroofed, rocked from their foundations and demolished. The air was literally filled with flying weatherboards furniture, laths and plaster. A parlor stove was caught up by the wind and hurled through the air until it fell upon a woman and crushed her so that she died. The Baptist and Methodist Episcopal churches were completely destroyed.

The tornado on its way to De Graff struck Bogg's flouring mill, five stories high, and containing 3,000 bushels of grain. The building was moved nine inches upon its foundation, and the roof and the portion of the fifth story were carried away. The storm plowed its way through De Graff, carrying destruction in its path, but injuring fortunately fewer persons and a smaller number of buildings. After leaving De Graff it passed several settlements, and finally rose from the earth and was seen for miles, carrying in its funnel shaped form timber, rails, and *débris* which it had gathered in its destructive march. The newspapers give the names of some fifty persons killed and wounded by this tornado.

Car Starter.

William M. Stratton and William E. Stratton, of West Troy, N. Y., have recently patented an improvement in apparatus for storing up, in a spring or springs, the power expended in arresting the motion of a car, to be used in setting it in motion again; and it consists in having the drum, which is employed to wind the tension cord of the spring, made with such devices and arranged in such manner that it may be locked and held after being detached from the gearing connected with the axle to wind it up, so that the car may be allowed to run awhile before the power of the spring is applied; thus making the apparatus capable of retaining the power stored up in the spring while the car is going down a descending grade and using it on an ascending grade, the car running free between the grades. The invention also consists in certain novel devices, for thus detaching, holding, and locking the winding drum.

CINCINNATI EXPOSITION.

The commissioners announce in our advertising columns that the third National Industrial Exposition will be opened in Cincinnati, September 4th, next. It will remain open until October 5th, following.

The aid which such exhibitions afford to business and the advancement of knowledge is of the most important character, and fully entitles them to the interest of the whole nation.

We would wish to remind intended exhibitors that they are recommended to make immediate applications for space.

Extensive arrangements have been made for the transportation of visitors, at reduced fare, and it is expected that the large attendance of last year will be very much increased this season.

THE UNIT MEASURE OF ELECTRICAL RESISTANCE.

Since the electric telegraph has been in existence, quite a number of different units of electrical resistance have been proposed, but at the present time nearly all of these units have been adjusted to one standard, so that one of them may now be considered the basis of all.

Professor Wheatstone proposed, as a unit, one foot of copper wire weighing one hundred grains.

Professor Jacobi proposed a copper wire one meter long and one millimeter in diameter.

Professor Matthiesen proposed a copper wire one statute mile in length and one sixteenth of an inch in diameter.

Mr. C. F. Varley's unit is a mile of special copper wire one sixteenth of an inch in diameter.

Dr. Werner Siemens employed a glass tube filled with pure mercury. This tube was one meter in length and contained a column of mercury having a transverse section of one square millimeter.

The German, French, and Swiss telegraphers used a certain length of their standard sized iron wire, such as was used for the construction of overland telegraph lines, as a practical unit of measurement.

The British Association proposed and adopted a theoretical unit of resistance, in which a certain amount of work or mechanical effect is produced by a given amount of electricity in a given length of time, and this theoretical resistance is copied or represented by a certain length of wire.

This unit is beautiful in theory, but difficult and uncertain in practice. The principal source of difficulty lies in the accurate measurement of the mechanical effect of the electric current. Since this unit has been adopted by the British Association, some of the most expert continental physicists have, by experiment, arrived at the conclusion that it is about two per cent smaller than the copies distributed by the association.

The objection to the employment of copper wire of various sizes as a standard arises from the fact that no two specimens of copper, or of any other metal, possess precisely the same specific conducting power, and, therefore, measures of resistance thus defined are liable to vary, and, in fact, do differ from each other very materially.

This objection, however, says the *Telegrapher*, does not apply to mercury, which, in consequence of its fluid nature, is easily rendered chemically pure. In fact, experience has shown that resistances can be produced and reproduced by means of mercury, which do not vary among themselves more than two or three ten thousandths of a unit, or about as near as the finest set of silversmith's scales can be made to balance and weigh alike.

In deciding upon a standard of measurement, the first and most important consideration is to select one which is least likely to undergo change or variation, so that, when they become multiplied and brought into general use, one of them will always correctly represent another.

If we suppose, for example, that a person should undertake to construct a two foot rule: He first selects a standard as nearly correct as possible, and copies it with great care. Suppose he then destroys the first and makes a third from the second, and a fourth from the third, and so on until he has made a thousand, and all of his measures, except the last one made, have been destroyed.

Now, we will suppose that another person commenced making two foot rules in the same manner, and using the same original standard to copy his measures from, and in the same way copied one from another to the number of a thousand. If these two persons compared their final measures with each other, it is more than probable there would be a considerable difference—that is, they would not agree one with the other. In view of this disagreement, how could it be decided which was the most correct, as the original standard is no longer in existence? In some such condition would two persons be, each having British Association units of measurement. They cannot get at the original unit, because it never had a practical existence.

The mercury unit, on the other hand, has for its basis the meter measure, which is defined as the ten millionth part of the distance of the pole of the earth from its equator, and very nearly the length of a pendulum that beats seconds.

The British Association unit forms part of a system. The resistance bears the same relation to the other conditions that distance does in the definition of a horse power. A horse power is that force which will raise 33,000 pounds one foot in one minute. Similarly, a British Association unit is the resistance of the circuit producing a defined mechanical effect or work in a certain time, with the other conditions of quantity and intensity defined as units. As before stated, the great difficulty lies in the correct measurement of this mechanical effect. In order to accomplish this, the British Association made use of a magnetic needle, that is, a magnet held in its position by the magnetism of the earth, which is never in itself constant, and is at all times in a state of perturbation. It results from this that the force required to move this magnet equally, at different times, will not be the same. In addition to this, the magnet is affected by local causes, and in no two different localities can it be said to be affected precisely alike. From these and other reasons, German scientists of the highest rank, as the result of their investigations, have announced that the British Association unit, as distributed by their committee, does not approximate its true value within nearly two per cent.

It was after careful consideration of the defects in the different standards of electrical resistance, and with the desire to adopt the one which was least liable to objection, that the International Convention of Electricians, at Vienna in 1868, adopted the mercury unit as a standard, and all the European countries, with the exception of Great Britain, have adjusted their resistance scales to it. Mr. Varley has defined his unit, or "readjusted it to 25 mercury units."

Mr. Latimer Clark defines the B. A. unit, or Ohm, as "the resistance of a prism of pure mercury one square millimeter in section and 1·0486 meters in length at 0° centigrade," so that, in reality, the mercury unit is now the basis or standard of all the measures in use.

The average resistance of a statute mile of good No. 9 galvanized wire, such as is generally used in this country, is about 20 mercury units.

Masonry and Brickwork.

However gigantic may be the strides with which engineering science has advanced during the last few years, it cannot be denied that, so far as regards the special art of building in masonry or brickwork, the present race of architects and engineers are feeble in conception, timid in execution, and but dwarfs of utter insignificance as compared with the giants of former days.

It would be amusing, or more truly perhaps the reverse, to note in what manner an average architect or engineer of the present age would deal with some of the problems presented to the old masters: for instance, such a one as that successfully solved by the Saracenic builder of the justly celebrated tomb of Mahomet at Beejapore, India, which was as follows: Given a building 135 feet square on plan, and 110 feet high, required to cover the same with a circular dome 124 feet in diameter, and weighing some twelve or fourteen thousand tuns. It would be curious to observe how many hundreds of tuns of iron our men would consider it imperative to throw into the work. The Saracen, knowing the capabilities of his material, asked for no ironwork, but fearlessly trusted to his masonry, and skillfully corbelled out the square walls at the top to meet and support the circular dome, and to such a bold extent that, at the angles of the building, the projection of the corbelling measured no less than 46 feet.

How infantile appear the greatest exertions of our modern building in comparison with such mammoth works as these! The traditions of the art have been lost, and science has provided no substitute. Our professors, if they do not avoid the subject altogether, treat it in a perfunctory, *ignotum per ignotius*, manner, which only serves to make the "darkness more visible," or the "little glooming light"—which may already exist in the student's mind—"more like a shade." We may be taught, for instance, that the line of pressure in an arch must be included in the middle third of its depth, or the arch will tumble down, and we may be treated to many other equally shallow *dicta* based upon hypotheses evolved from purely theoretical considerations, which the bare existence of hundreds of buildings for hundreds of years conclusively demonstrates to be utterly false and untenable.

In recent times, no doubt, the introduction of iron work has had much to do with the extinction or suppression of nearly all that is true and expressive in the art of building. It is so very easy to multiply the span and divide by the depth, and to perform the other elementary operations incidental to the determination of the strength of an iron girder; and then, besides, the figures and diagrams look so clever as to induce, in the too often shallow performer, a glow of self complacency, leading him to fervently believe that an engineering feat has really been achieved. But if such work constituted engineering, the schoolmaster in the "Deserted Village" would be an admirable exponent of the science:

> The village all confessed how much he knew;
> 'Twas certain he could write, and cipher too.

Another advantage offered by ironwork as compared with masonry, and one to indolent or incompetent men peculiarly seductive—is that of shirking responsibility. With iron girders, the designer may devote the few minutes necessary to the conventional calculations, specify iron of a given strength, and so rid himself lightly of any further sense of being responsible. But if, on the other hand, his first consideration is his client's interest, and not his own ease, he will often be led to discard ironwork in favor of masonry, and he will find no royal road to learning in that direction, but must honestly and laboriously qualify himself, by theoretical and practical investigation and by comprehensive analyses of works already executed, to form a correct estimate of the capabilities of the masonry or brickwork with which he may dealing, and to shape his design accordingly.—*Engineering.*

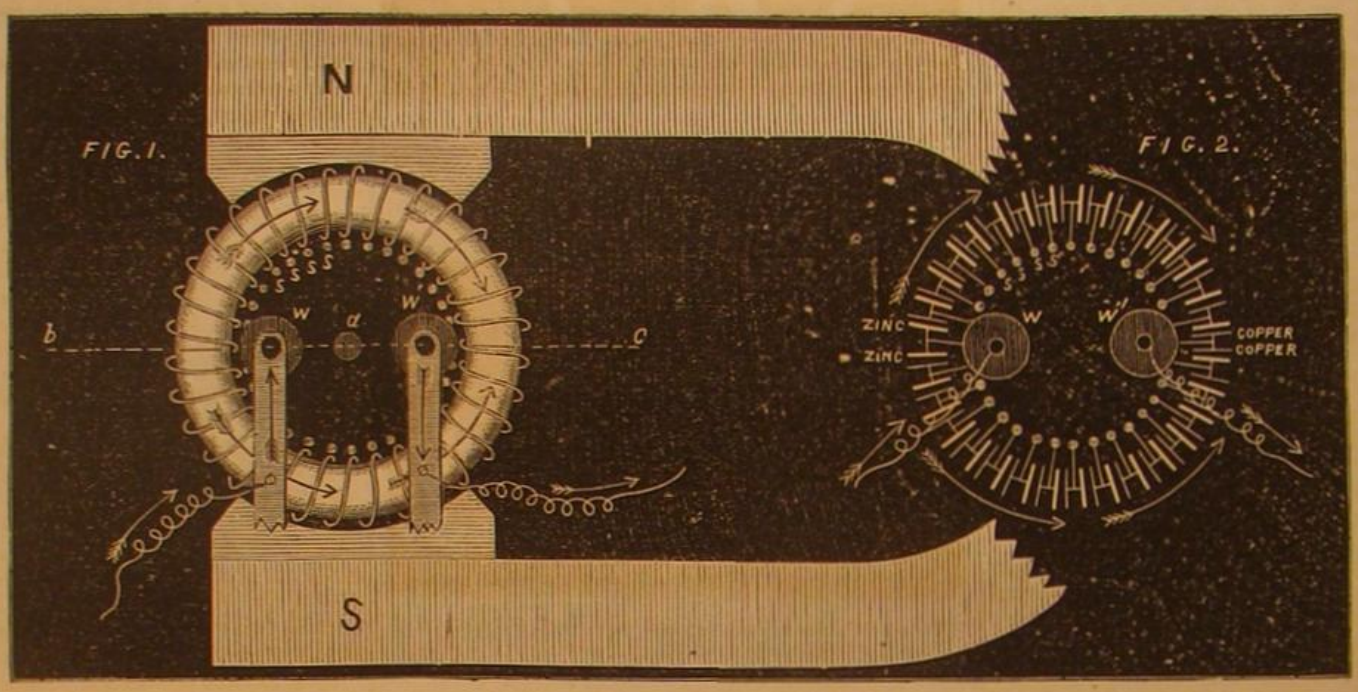
OZONE IN THE AGEING OF ALCOHOLIC DRINKS.—On running out wine drop by drop through a vessel filled with ozone, the essential oils and other substances which give the wine a "new" flavor are destroyed, and the wine much improved in quality.—*M. Leon.*

NEW MAGNETO-ELECTRIC MACHINE.

In all the magneto-electric machines hitherto constructed, only an approximation to a continuous current has been arrived at, and that either by making each machine a compound one, having several armatures arranged so that, when the current ceased in one, it was taken up by the next, and so on, or, in other machines, by driving the armature or armatures at a very high velocity, so that the interval between the cessation of one current and the commencement of the next became inappreciable.

In M. Gramme's machine, says the *Mechanics' Magazine*, the current, whether the machine be turned slowly or quickly, is continuous. Fig. 1 is a theoretical representation of this machine. It consists of a horseshoe magnet, N S, between the poles of which turns an iron ring with an insulated wire wound round it in one continuous length. The inner bends of the turns of this wire are connected with small studs, *s s s s*, insulated from one another. The edge of the faces of two wheels, *w w'*, press against these studs, as shown, so that as the iron ring with the wire wound around it rotates, three or more of these studs are always in contact with them. In the actual machines, each of the turns, as represented in the engraving, is really a separate coil of several turns of wire, the junctions between the ends of one coil and the next being connected with the studs; and the iron ring is not necessarily one of round iron, but may be, or rather is, a short and very thick soft iron tube, and the permanent magnet a proportionally broad compound one. The action of the machine may be explained as follows: Let us regard the turn of wire just above the line, *b a c*, on the left hand side of the ring. The portion of the iron ring above this turn, that is to say, the portion nearest the pole, N, has the same polarity as that pole, while the portion of the ring below the turn has southern polarity. Now as the ring rotates about *a*, the portion of the ring above the line, *b a c*, becomes more strongly north as it approaches N, and the part below less south as it recedes from S; and, finally, when it arrives at N, the polarity on both sides is the same, which is as much as to say there is no magnetism in it. This change causes a current of electricity to be induced in the wire. As the turn now moves on towards S, the iron in front becomes a south pole, and that behind a north pole, until it arrives at the line, *b a c*, when the difference of polarity is greatest. This change sends another current through the wire, which, as the turn has become turned over in position, will be in the same direction as the former one, or rather will be a continuation of the first current, so that the turn of wire, in changing from *b* to *c*, has a continuous current induced in it, as have in like manner all the turns before and after it. As now the turn moves farther still, the magnetism becomes less and less, as at first, and finally, when at S, disappears, and on going still further becomes reversed as before; this causes a current to circulate through it in a reverse direction to the former one, and so also for all the turns before and after it; these currents together pass out through the studs, in contact with the wheel, *w*, and return when the circuit between the two wheels is completed (as they must be of course before any current can flow) through the wheel, *w'*, and thus a continuous current is kept up as long as the wheel is kept rotating. The circuits of the machine are precisely similar to two sets of cells joined up for quantity, that is to say, the last zinc plate of one set is joined to the last zinc of the other set, and also the last coppers are joined, as shown in Fig. 2, each cell representing one turn, or in the actual machine one separate coil.

It will be seen that as each wheel always presses against three or more studs, the coils between these studs are short circuited, and do not add their power to the others. The resistance of the wire in the machine will be the resistance of the length of wire between the stud pressing against the higher part of the wheel, *w*, and the stud pressing against the higher part of the wheel, *w'*, taken parallel with the length of wire between the studs pressing against the lower part of the wheels, which is equivalent to rather less than a quarter of the resistance of all the wire taken in one length. The resistance is not exactly a quarter, because the coils between the studs pressing on the wheels are in short circuit, and do not add their resistance to the other wire. By constructing the coils of thick wire, a current of great quantity can be obtained, or with a larger length of thin wire, one of great intensity. The electro-motive force of the current is directly proportional to the rate of rotation of the coils—that is, when the rotation is not extremely rapid, for the demagnetization of the iron requires a certain time. The machine, from its great simplicity, is likely to have an extended use for such purposes as electrotyping, the electric light, etc.



MAGNETO-ELECTRIC MACHINE.

Lac Anilines for Staining Paper, Leather, etc.

Springmuhl states that paper has hitherto been stained in two ways: either the material, previous to manufacture, was dyed with a substantive color, or an adjective color was applied to the finished paper. In the former case, a product was obtained colored through and through; in the latter, the color is only on one side. With a compound of resinous matter and aniline colors dissolved in alcohol, the paper can be rapidly colored at once, on both sides, in the most splendid manner and in an infinite variety of shades. The best resin for the purpose is shellac, to which a little sandarach or turpentine may be added. The resinous aniline solution interpenetrates the whole mass of the paper, giving it a completely even color, and a considerable luster. The two alcoholic solutions of color and of resin may, if needful, be kept separate till required for use.

Every kind of paper, sized as well as unsized, can be prepared in the same manner. The process is very simple: the sheets of paper are drawn through the solution placed in a shallow vessel, and afterwards hung up to dry. By wetting one side of the paper, the same result may be produced, if the texture is not too thick. If the paper is thoroughly interpenetrated with color, it becomes, when dry, so compact and dense that one side can be subsequently treated with a different color. By adding a small quantity of an essence, the paper may at the same time be perfumed. Leather, etc., may be treated in the same manner.

SAFETY KEROSENE LAMP.

Many of the accidents resulting from the use of kerosene arise from the breaking of the glass reservoir when the lamp is overturned by any cause. To obviate this is the intention of the invention we illustrate, and the object appears to be attained by means at once simple and inexpensive.

At A is shown the glass reservoir of the lamp, and at B a ring of india rubber which surrounds its largest circumference. A groove is formed in the glass, into which the rubber ring falls far enough to be kept securely in place, while, at the same time, it projects a sufficient distance from the reservoir to form a protective cushion on every side. Upon the lamp being overturned, the india rubber cushion receives the force of the concussion and preserves the glass from injury. We have upset the lamp from which our cut is made a great many times, to test its strength, without effecting any damage whatever.

Patented through the Scientific American Patent Agency, April 16, 1872. Further information can be obtained of the inventor, Mr. Adolph Otto, whose present address is 76 Ann street, New York city.

PENCIL LEADS.

Graphite, clay, and water are the ingredients of the leads used in the ordinary forms of pencil cases sold by jewelers and stationers. The graphite, or blacklead, as it is commonly termed, that is employed for the purpose is of the finest quality. After being ground to a powder, it is mixed with a peculiar dark blue clay, which is imported from Bavaria, and the whole is kneaded with water until it assumes the consistence of putty.

The apparatus used in the manufacture consists of an iron cylindrical vessel, which is usually of about seven inches in diameter, and constructed of sufficient strength to withstand heavy pressure. In the center of the bottom of this vessel, a small round hole is pierced, and inside the cylinder is a closely fitting movable steel plate which also has an aperture in its center, so that, when it is placed on the bottom of the vessel, the two openings coincide. The hole in the plate, however, is the smaller, being of a diameter equal to that of the leads to be made—so that larger or smaller apertures and, consequently, different plates are required for the various sizes of leads.

Into the above mentioned vessel, after the plate on its bottom is adjusted, the mixture is packed, which, on being forced down by a heavy pressure, is driven out through the hole in long flexible threads. These are received on sheets of metal, and each sheet, as soon as filled, is placed in an oven. The length of time occupied in the baking depends upon whether the leads are to be hard or soft; if the former, they are kept in the oven for some time, if the latter, a short period suffices. This process completed, the threads are broken up into short pieces and arranged according to their sizes. There are nine of these sizes in the trade, numbered from 1 to 9 according to the length of the pieces.

The finished leads are sent to the market packed in little boxes. The latter are either turned from wood or else pressed by dies from thin sheets of tin or brass. Large numbers of them are manufactured at Waterbury, Conn.

Leads at wholesale sell at three dollars per gross. The trade, which is supplied mostly from manufactories in Philadelphia, is, we should judge, of rather limited proportions, as one of the largest dealers in this city informs us that his sales rarely exceed three thousand gross per annum.

SCARLET DYEING ON WOOL AND SILK.—Jegel proposes the following method of dyeing wool and silk scarlet by the simultaneous action of magenta and dinitronaphthol or naphthaline yellow. The less magenta is employed, the better. The method is to heat a dilute aqueous solution of naphthaline yellow to near boiling, add so much magenta as amounts to two per cent of the naphthaline yellow, and then dye. The dye liquor must not be mixed when cold. If this is done, all the magenta is thrown down in an amorphous flocculent state. If this has taken place, the subsequent application of a boiling temperature does not remedy the mischief, since a part only of the magenta thus precipitated is redissolved, the rest melting together into a greenish golden mass. In this state, the liquid is quite unfit for dyeing, and even if filtered gives no good shades.

PREPARATION OF PURE INDIGOTINE BY MEANS OF CARBOLIC ACID.—According to Mehu, carbolic acid, with the aid of heat, has the power of dissolving indigo blue readily. On cooling, the greater portion is deposited in a crystaline state. The cold solution has an intense purple blue color. In order to prevent the carbolic acid from congealing as it cools, a little alcohol may be added, which causes the greater part of the color to be deposited. Instead of alcohol, camphor may be used to the extent of one-fifteenth, or benzine. By using 500 grammes of carbolic acid, we can obtain two grammes of pure indigo blue (indigotin) in crystals which, under the microscope, appear remarkably regular. Mehu employs indigo which has been previously washed, first with water, then with very dilute hydrochloric acid, and then repeatedly extracted with boiling alcohol.

COATING ZINC WITH IRON.—The objects should first be plunged into a hot solution of 160 gms. ferrous sulphate and 90 gms. sal ammoniac in 2,500 c.c. of boiling water. After two minutes' exposure, they should be removed and brushed off in water. This has for its object simply the cleansing of the surface. They are then again placed in the bath and heated, without brushing or washing, until the sal ammoniac fumes are gone, then washed, and this operation repeated three or four times, when a coating of iron will be formed on the zinc, which takes a fine polish under the brush.—*M. Puscher.*

Miners' Unions in Prussia.

The oldest associations amongst working men for mutual aid, of which modern trades' unions are the youngest off spring, are unquestionably the "Knappschaften," or miners' unions of Germany. They date back more than 600 years and were established wherever German miners migrated; they had written rules and regulations, and generally received corporate rights from the respective sovereigns who wished to encourage mining enterprise within their own dominions, particularly for the sake of winning precious metals. The German miners' unions exist over all Austria, Russia, Norway, and Sweden, where the art of mining was introduced from Germany; and the technical terms, still in use by the profession in these countries, bear witness to their German origin, as well as the general mining laws which regulate the acquisition of mining property from the State and the obligations of mining proprietors towards the sovereign, who holds all mineral treasures under regal rights. In no other country but Prussia, miners' unions or "Knappschafften" have been developed with so much care by legislation for the general benefit of the working miners; and though they are still capable of improvement, they can fairly be pointed out as models which are worthy of imitation for the benefit of the other working classes. The report on the miners' unions in Prussia during the year 1870 has lately been published, and we find in it data which may prove of value to the mining interests of this country, where the improvement of the social condition of a large population of miners is just now being eagerly discussed.

The war of 1870 has not failed deeply to affect the condition of the "Knappschaften," as over 30,000 members were forced by it to leave their peaceful calling and to enter the ranks of the army. The direct object of the miners' associations is to render immediate assistance to its members when they are in need of it, so that, if injured by an accident or if taken sick, they receive assistance during the duration of their illness, besides free medical treatment and medicine. If their case should make it desirable, they are received without cost at one of the unions' infirmaries; and in the event of death, the union furnishes the funeral expenses. If, through any accident or through age, they become too infirm to gain any wages by their work, they receive for life a pension out of the common fund; and according to the degree of their infirmity, they are classed as pensioners, or half pensioners, and obtain help accordingly. If a member leaves a widow and children behind him, the former receives a monthly pension until she dies or marries again, while the children are assisted until they are 14 years old, besides free school to the same age. There are two classes of union members, permanent and temporary, the latter only acquiring personal rights, while the former, after 5 years membership, have their rights extended to all the members of their family; but both classes forfeit their rights when they leave their union without permission, or cease to pay their contribution, which, as a rule, is 3½ per cent of wages earned. The property of the union is thus principally derived from contributions of the members, but also to no small extent from voluntary donations, as well as from contributions of 1 per cent on their incomes, which the mine owners are legally obliged to pay. This fund is under the management of a committee of trustees, "Knappschafts Aelteste," who are freely elected by the members and placed under the control of the Government mining engineer of the district, who is made responsible, to prevent defalcations and to see that members always obtain justice.

On the 1st of January, 1870, the miners' unions comprised 202,562 members, of whom 102,174 were permanent and 100,388 temporary. The number of persons supported by the unions during the year was 45,057, namely, 9,267 pensioners, 277 half pensioners, 13,883 widows, and 21,630 orphans, and school money was paid besides for 45,402 children. The total income of the union was $1,600,000. During the year, medical assistance was rendered to 117,025 persons, sick wages were paid for 1,436,826 days, and 9,486 members received, in all difficult cases, free medical treatment at the hospital. Most of these cases were the results of accidents. —*Engineering.*

FAST RIDING.—At Dexter Park, Chicago, recently, Charles Rettiker, "the California Boy," undertook the feat of riding on horseback 200 miles in twelve consecutive hours, being at an average speed of sixteen and two thirds miles per hour. The track used was the circular one, seven eighths of a mile in length. Fresh horses were used for each round. On the the twenty-fifth round, the horse bolted the track and leaped the rail, falling upon its rider, who, however, not being much hurt, remounted and finished the round. On the 198th round, the race came to a sudden termination, as the horse again jumped the fence and threw his rider with such force that he was obliged to be taken from the park in a carriage, and he now lies in a very low state, although the physician has some hopes of his recovery. He had made 172½ miles in nine hours and twenty minutes, and but for the accident would undoubtedly have accomplished the feat.

GALVANIC ACTION ON IRON SHIPS.—It is an alarming fact in practice says the *Engineer*, and one that, being so perfectly in accordance with theory, ought to awaken no surprise, that should even a minute piece of copper come into contact and so remain, with the inside bottom of an iron ship then wetted with bilge water, as under the circumstances of the case, it, necessarily must be, active galvanic energy is established between the two metals, and iron being the sacrificial metal of the couple, the bottom will, sooner or later—and sooner rather than later—be eaten through in a hole somewhat larger than the superimposed copper.

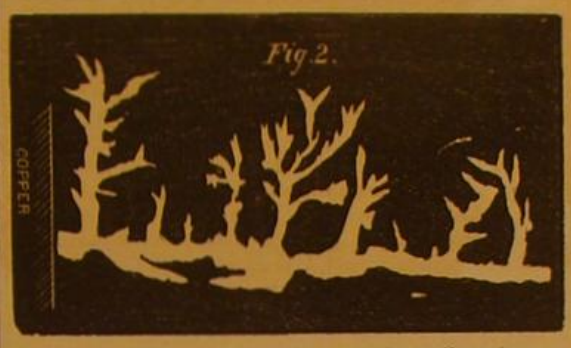
CRYSTALLIZATION OF SILVER, GOLD, AND OTHER METALS.

BY DR. JOHN HALL GLADSTONE, F.R.S., F.C.S.

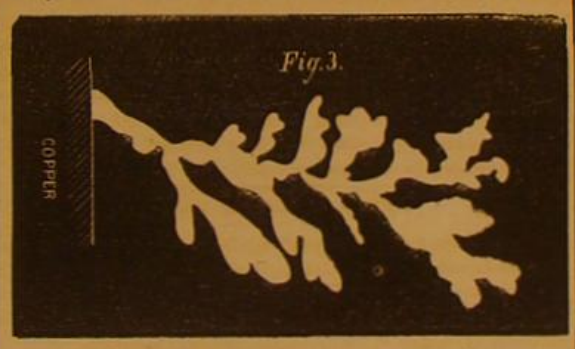
There are few chemical experiments so well known as the growth of the lead tree, a specimen of which is on the table, together with a silver tree that is said to have been made by the late Professor Faraday. These carry our minds back to the time of the alchemists, who called the first, *arbor Saturni*, and the second, *arbor Dianæ*; and they may be looked upon as the types of a large number of phenomena, in which

the salt in one metal in solution is decomposed by some other metal. My assistant, Mr. Tribe, and myself have been lately examining these replacements, the metallic crystals which are thus produced, and the forces that act through the liquid.

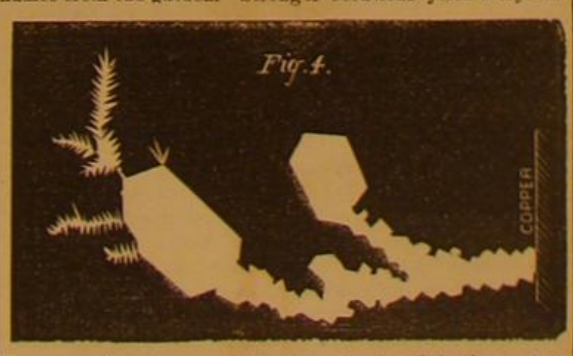
Our more special attention has been given to the action of



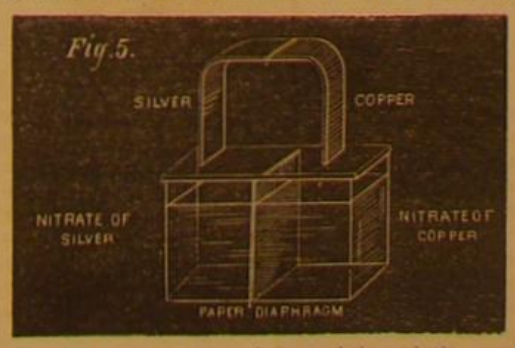
copper and nitrate of silver. The crystals of silver thus produced differ both in color and form, according to the strength of the solution. If it be very weak—say one per cent—the copper is fringed with black bushes of the metal, which, in growing, change their color to white without any alteration of crystalline form that can be detected by a powerful mi-



croscope. A stronger solution gives white crystals from the commencement, which frequently assume the appearance of fern leaves; the analogy between crystals and growing plants is a most superficial one, but it is convenient to draw our names from the garden. Stronger solutions yield a crystal-



line growth rather resembling furze bush, while those of 15 per cent or upwards give a steady advance of brilliantly white moss. In all these cases, however, when the solution in front of the growing crystals has been somewhat exhausted, certain prominent or well circumstanced crystals seem to mo-



nopolize the power, and to push forward through the remaining portions of the liquid. This gives rise to beautiful branches, which assume a variety of graceful forms, but, as a general rule, the weak solutions give feathery and pointed crystals, as in Fig. 1: the moderately strong solutions tend towards jagged forms, as in Fig. 2; while the strongest grow branches that terminate, not in sharp points, but in rounded leaflets, as in Fig. 3. Besides this, there occur all kinds of crystalline combinations, as for instance, the spray sketched in Fig 4. It is very beautiful to watch the growth of these silver crystals round a piece of copper under the microscope; a blue glass underneath adds to the effect, but they are best seen when they reflect a strong light thrown upon them. If, instead of putting a piece of copper into a drop of nitrate of silver, a piece of zinc be placed in one of terchloride of gold, there is at once an outgrowth of black gold, which speedily changes to an advancing mass of yellow, or perhaps of purple metal; and it is very apt to form beautiful fringes, or to shoot its yellow branches rapidly round the margin of the drop. Acetate of thallium yields a forest of thorny crystals; and chloride of tin causes a luxuriant growth of large flat leaflets, or of symmetrical structures resembling fern leaves, except that the smaller fronds are arranged at right angles to one another. The new metal indium gives thick white crystals upon zinc; while bismuth and antimony form black fringes resembling the first action of gold.

The forms assumed by native metals resemble those produced by this process of substitution. In some cases, indeed, it seems almost certain that the deposition of these minerals was effected in the same way, as for instance, the silver which occurs sometimes in tufts, sometimes in large crystals, on the native copper of the Lake Superior district. Gold is frequently found in cubes more or less rolled, but the leaf gold from Transylvania bears a striking likeness to the crystals that form in our laboratory experiments. Silver is often found native as twisted hairs or wires of metal—a form that never occurs in the decomposition of its nitrate by copper, but which can be artificially produced in another way.

There has been noticed a singular tendency in old silver ornaments and coins to become crystalline and friable. Here is an ancient fibula from the Island of Cyprus, supposed to be at least 1,500 years old, which, through the greater portion of its substance, presents a fracture something like that of cast iron, and its specific gravity has been reduced in round numbers from 10 to 9. It contains a little copper. This property of certain metals, or their alloys, to change in condition and in volume, is worthy the attention of those whose duty it is to make our standards. Experiments should be instituted for the purpose of learning what metals or combinations of metals are least subject to this secular change.

These metallic crystals are Nature's first attempt at building. The material is the simplest possible—in fact, what chemists look upon as elementary. But how is the building carried on? What are the tools employed? Where are the bearers of burdens that bring the prepared pieces and lay them together according to the plan of the Great Architect? We must try to imagine what is taking place in the transparent solution. The silver, of course, existed at first in combination with the nitric element, and for every particle of silver deposited on the growing tree, an equivalent particle of copper is dissolved from the surface of the plate. The nitric element never ceases to be in combination with a metal, but is transferred from the one metal to the other. On the polarization theory, the positive and negative elements of the salt constantly change places and enter into fresh combinations, one consequence of which would be a gradual passage of the nitric element from the growing silver to the copper. This actually takes place, and there is a diminution of the salt at the ends of the silver branches, giving rise to an upward current, and a condensation of nitrate of copper against the copper plate, which gives rise to a strong downward current. These two currents are seen in every reaction of this nature. In the case of silver and copper, however, it has been proved that the crowding of the salt towards the copper plate is more rapid than would follow from the polarization theory. The instrument employed for determining this point was a divided cell in which two plates, one of silver and the other of copper, connected together by a wire, are immersed each in a solution of its own nitrate, contained in each division of the cell, and separated from one another merely by parchment paper. The crystals of silver deposited on the silver plate in this experiment are very brilliant.

There are other indications of the liquid being put into a special condition by the presence of the two metals which touch one another. Thus zinc alone is incapable of decomposing pure water, but if copper or platinum be deposited on the zinc in such a manner that the water can have free access to the junction of the two metals, a decomposition is effected; oxide of zinc is formed, and hydrogen gas is evolved. At the ordinary temperature, the bubbles of gas rise slowly through the liquid, but if the whole be placed in a flask and heated, pure hydrogen is given off in large quantity. We have also found that iron or lead similarly brought into intimate union with a more electro-negative metal, and well washed, will decompose pure water.

As might be expected, the action of magnesium on water may be greatly enhanced by this method; and a pretty and instructive experiment may be made by placing a coil of magnesium in pure water at the ordinary temperature, when there will be scarcely any effect visible, and then adding a solution of sulphate of copper. The magnesium is instantly covered with a growth of the other metal, and at the same time the liquid seems to boil with the rapid evolution of hydrogen bubbles from the decomposed water.

When, however, the force of the two metals in contact has to traverse a layer of water, the resistance offered by the fluid prevents its decomposition. This must also be an important element in the decomposition of a metallic salt dissolved in water, and, in fact, we have found that the addition of some neutral salt, such as nitrate of potassium, increases the ac-

tion—apparently by diminishing the resistance of the liquid. If, too, we increase the quantity of the dissolved metallic salt, we get more than a proportional increase of deposited metal. Thus, in an experiment made with the different strengths of nitrate of silver on the table, the following results were obtained in ten minutes, all the circumstances being the same except the strength of the solution: 1 per cent solution dissolved ·025 grammes copper; 2 per cent dissolved ·078 grammes, and 4 per cent dissolved ·224 grammes.

In fact, it had been found that, in solutions not exceeding 5 per cent, twice the amount of nitrate of silver dissolved in water gave three times the amount of chemical action; and this was true with other metals also in weak solution. It is likely that this is not the precise expression of a physical law, but it agrees at least very closely with the results of experiment.

The power arising from this action of two metals on a binary liquid may be carried to a distance and produce similar decompositions there. This is ordinary electrolysis. Metals have been crystallized from their solutions in this way, and Mr. Braham has made excellent preparations of crystalline silver, gold, copper, tin, platinum, etc., by using poles of the same metal as is intended to be deposited upon them. The forms thus obtained are precisely analogous to those produced by the simple immersion of one metal into the soluble salt of another, and illustrate still further the essential unity of the force that originates the two classes of phenomena.

Correspondence.

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

A Plea for the Classics.

To the Editor of the Scientific American:

In your issue, dated May 25, I noticed, in an article entitled "How to Conduct Scientific Investigations," this sentence: "Not only are physics and mechanics more pleasant studies than Latin, and chemistry more interesting than Greek grammar, but we assert that a man may make more money, by applying a mere superficial knowledge of these sciences, than by a much more profound knowledge of the dead languages." From the above, one would draw the conclusion that money making was the chief end of man. If that be so, perhaps the writer is correct. But man was born for a higher purpose than the simple attainment of wealth. I maintain that every man who comes into the world was put here to make humanity better for his being in it, and not only for his own aggrandizement; and he who fails in this, fails to do his duty. Society demands some benefit from all, in order that it may advance. And fine literature will cause this advancement. I challenge any man to bring forth writings on any scientific subject whatever, chemistry or botany, natural history or mineralogy, and in them will be found derivations from the dead languages. Ask any eminent lawyer what advantage he has gained from the study of Latin and Greek; the universal answer will be "almost every thing." Look at his law books, and you will find nearly every alternate word to have derivation in the ancient languages. Although I do not wish to depreciate Mr. Bryant's translation of Homer, yet I assert that no one can fully appreciate the work until he has read the original Greek. A man may have the most "profound knowledge" of any science, and yet it would be almost impossible for him to deliver a lecture on that subject and not make some stupendous grammatical mistakes, provided he is ignorant of the classics, thereby making himself the laughing stock of the community. Not long since, a case came under my personal observation, in which a young man who never had looked into an English grammar, yet had a tolerable knowledge of the classics, was placed in an examination on that subject (English grammar), with several who knew nothing of Latin or Greek, but had always studied English; the consequence was that the one understanding Latin passed better than three fourths of the rest. This only goes to prove how utterly dependent our own language is on the classics. When a boy or girl is striving to obtain an education, he or she should not only study what will be of practical utility, but what will prepare the learner for the battle of life. The study of these languages gives the brain a thorough drill that can be obtained in no other manner; it compels the mind to think, and think correctly; to rely on its judgment, not on its memory; whereas mathematics and natural sciences give exercise only to the latter, which, too often, is fickle. Step into the Senate chamber of the United States, count the noses, and you will find that a majority of the members are classical scholars and college bred men. From the foregoing remarks, no reasonable man can fail to see that, while the sciences have their uses, they are still dependent upon language for their elucidation. And granting that more money may be made by their immediate use, nevertheless the classics lend influence to the "pen,' which rules the world, and which, as all men know, is more "powerful than the sword." In conclusion, allow me to quote the memorable passage of Cicero: "*Idem ego contendo, cum ad naturam eximiam atque illustrem accesit ratio quædam conformatio doctrinæ, tum illud nescio quid præclaram ac singulare solere existere.*"* G. L. F.

*Similarly, I assert that when reason adds, to an exceptional and enlightened nature, some system of education, the celebrity and distinction that there may lie in is unknown.—*Eds.*)

Testing Turbines.

To the Editor of the Scientific American:

As a well written communication by Mr. A. M. Swain, in the SCIENTIFIC AMERICAN of June 1st, on the subject of turbine wheels, pointedly alludes to a short article of mine, on page 228 of the current volume, and somewhat misconstrues me, I beg to say a few words in reply, not defensive, for my impression is that such are not needed, nor controversial, for I have not the time even if you had the space.

The inference seems to have been formed that the test of which I spoke was made in raising water. I did not intend to say this. I suppose in every test, if its commercial aspect is to rule, the water discharged, time, and the net result, are the elements of calculation. In this case, the head was 110 feet, the water discharged by the hydraulic engine—not a ram—about 42 per cent of what the turbine used for the same work in raising a weight. If there is a more simple method, a more accurate one than this, I would like to know it. In Mr. Swain's communication, overshot wheels are instanced. I propose to follow them up as proof. If an ordinary over shot receives pressure earlier than at 45° away from a vertical line through its shaft, it discharges it enough earlier, than at the corresponding angle below the shaft, to render it next to certain that the full weight of the water utilized cannot be greater than what is due to the capacity of the buckets between these points. This quantity would be represented by the 90° remaining between them, or 50 per cent of the weight of water the buckets would contain if the whole diameter of the wheel were effective. How then could 70° of the discharge be raised to its head, even if taken from the tail-race? And much less could it be done if taken from a mine.

There is, doubtless, some "inaccuracy" about the process. A parallel holds good as between an overshot wheel, using about 90° of its circumference, and a hydraulic engine. In each, if the instrument is withheld from movement, the power is retained; but with a turbine, a forcible total stoppage only checks the flow, and power is lost. If in the most approved turbines, 8 per cent of water under pressure is intentionally freed, is it not done to give the best effect to the balance? And if so, does it not go to show that my use of the word "speculation" was not loosely taken?

This loss by a turbine, I hold to be a fair representation of the disparity between the two systems; but it is very much understated in the 8 per cent; and the 12 per cent is demanded as a reasonable allowance for other things. Wherever allowances are asked, that have not been, perhaps cannot be, proved to be precisely right, I must still call them speculation. Only the weight of the water can be used as power, and a turbine does not use the whole. I cannot say that 86 per cent of the power of water upon an overshot wheel has not been utilized, but I am incredulous for the reasons stated, even though the buckets were made to trip, after a vertical passage the distance of the diameter of the wheel. Your correspondent, in speaking of the test I suggested, to wit, that of forcing back to its head as much water as the power would raise, has apparently overlooked the allowance I proposed for every necessary mechanical obstacle. This allowance need not complicate the process; the difference between the quantity discharged and that replaced would measure the exhaustion of power; then if the "necessary obstacles" were or could be measured, and added to the replacement effect, raising it to its original condition in the reservoir, my case would be lost. I have no arguments against turbine wheels; they are excellent devices and are doing immense service; but I only do not believe that they have ever used the percentage of power claimed. R. H. A.

Baltimore, Md.

The Cherokee Tribe of Indians---A Subject Interesting to Antiquarians.

To the Editor of the Scientific American:

If I am correct in memory, it was near twenty years ago when I met with Henry E. Colton in Macon county, North Carolina, and his business seemed to be an inquiry after the ancient relics, as well as traditional history, of the former inhabitants of the country, to wit, the Cherokee tribe of Indians. Mr. Colton directed one enquiry to myself: "What could have been the intentions of the Cherokee Indians in building so many large earth mounds that were met with in the low grounds of these mountain valleys?" My reply was that "the Cherokee tribe of Indians disclaimed all knowledge of the origin of those earth mounds, as well as the purposes for which they were built; and, furthermore, that I had evidence, satisfactory to myself, that these mountain valleys had once been inhabited by some race of people antecedent to their occupancy by the Cherokee Indians; and that this fact I inferred from the wide diversity in form, material and quality of their pottery, as well as their edged or cutting utensils, but more particularly as regarded their mode of sepulture, which, in all races, is permanently fixed; and in pursuance of this subject, I related to Mr. Colton the following incident: After the Cherokee Indians abandoned the country in the year 1821, I, in a spirit of romance, became a small farmer in a wild and picturesque valley in the country the Cherokees had left; and while plowing, in a low ground or bottom fields, in passing over a certain spot the plow produced a rumbling hollow sound, and this led to digging—rather scraping away the earth—in quest of the cause; at the depth of fourteen inches I met with charcoal, and then a clay slab that had been so highly indurated by burning that it had the hardness of a brick. An effort was made to take this slab up entire, as it was but seven feet in length and four in width; but this we failed to do, as it broke in turning it over. But what was our astonishment to find, on the reverse or under side, the complete cast of a human body, not a vestige of which was to be found! From all the appearances, the opinions I formed at that time (and these opinions have not changed) were that at some remote point in the world's human history, some peculiar race of people inhabited this country, whose mode of sepulture was to place the body of their dead in a shallow grave in a nude state and on its back, with the limbs extended at full length, cover it with soft clay mortar, pile wood upon it and consume the body with fire. Furthermore, the problem was suggested: May it not be that this race, so far back in the history of man, were the mound builders? In my farming, I found but two other of these burnt clay sepulchres. All of these facts I narrated to Mr. Colton, and about thirty years after their discovery, and after the abrasion of time and the wear of the plow share in farming my lands had reduced these casts in the clay slabs to fragments.

For the first time after the delivery of the above narrative to Mr. Colton, I met with him at a Cherokee Indian ball play, and this was in the year 1860; and he addressed me, as I then thought, somewhat rudely, in these words: "Mr. McDowell, some years ago you described to me some peculiar Indian sepulchres you had found in your fields—have you, since then, discovered any more of these?" My reply was "I have not." He rejoined: "The reason why I now name this subject is this: I published your narration, and archæologists and antiquarians give no credit to your story, because, they say, it is contradictive of all the modes of sepulture yet discovered among the various tribes of Indians on this continent, and it is due to your reputation as a man of truth to find and exhibit one other of these sepulchres." I was wilted by Mr. Colton's words and manner, because, not knowing for why, I felt as though I were half a villain. I made him, I fear, an unmannerly reply that was more practical than pious, and have not seen Mr. Henry E. Colton since, nor have I searched for another sepulchre for the purpose of redeeming my lost reputation as a man of truth.

And yet a kind Providence has saved me, from going down to my grave disgraced, in this way: The 16th day of this month was the recurrence of my seventy-seventh birthday, and a team of oxen were pulling a deep running plow through my field, when the point of the plow struck upon the side of one of these burnt clay sepulchres and rent from it a small portion of an arm. I had the plowing stopped, and the locality marked, and it shall remain intact until some scientific individual arrives who can superintend the delicate process of raising the sepulchral slab without injury to the cast of the human figure impressed upon it. I have intrusted the procurement of the proper man to direct this delicate operation to Colonel C. W. Jenks of St. Louis, now superintending, for the American Corundum Company, the working of the Cullasajah corundum mines in this county.

Franklin, Macon county, N. C. SILAS MCDOWELL.

P. S. Since the 25th inst., when Colonel Jenks and myself conversed publicly on the above subject, eleven of these sepulchres have been reported to me, found in different localities. S. McD.

Do Snakes Charm Birds?

To the Editor of the Scientific American:

In taking a morning stroll by a board fence, I discovered a cat bird fluttering along on the edge of the top board, which was about one inch in thickness; and walking closely up to it, say within four or five feet, I discovered a black snake, about four or five feet long, lying well balanced on the edge of the top board. Neither the bird nor his snakeship seemed at all disturbed at my proximity; but the former, crying and with hanging wings, would advance and retreat, each time seeming to approach nearer to the glistening eyes of its charmer. My sympathy was at once aroused for the bird, and fearing that in its next advance it would be taken captive, I took off my hat and held it on the fence about two or three feet from the snake's head "to break the charm;" but to my surprise, as before, here came the bird towards the hat; it flew over it and lit on the fence near to the serpent's tail. I then armed myself with a cudgel about two feet long, and stepped back about a rod from the parties to observe strategic movements. The bird continued the same movements at the tail which it had done at the head, advancing and retreating, drawing nearer each time, until finally it lit on the tail, then off on the fence, still fluttering, chirping and crying. His snakeship did not seem to fancy an attack in the rear, and slowly lowered about one foot of the tail end, and let it hang down the side of the board. The bird, encouraged by this move, again and again lit on the back part of the body toward the tail and once struck it with its bill. The snake not being able to turn its head back and keep its balance on so narrow a base, it retreated from the bird, coming towards me (it seems that I was not worth its notice), moving slowly along until it reached the post, passing it far enough for the middle of its body to rest on the post. I began to think that it had given up the chase; but not so, for, with all the wisdom of the serpent and the calculations of a civil engineer, he turned his head, doubling himself until his head was within about six inches of the end of the tail, head slightly elevated, and seemed to say: "Now, birdie, come on." Sure enough, it came, fluttering and crying as before. I advanced to within about three feet of the snake, stick in hand, ready for the "clash of arms." The bird approached so near before retreating, I feared to let it advance another time, and immediately made battle in its behalf, and so slew the "sarpint." A darkey, witnessing the conflict, took the snake, saying: "I will hang him up wid his belly to de clouds to make de rain come." And now I cannot tell whether or not a snake can charm a bird; can you?

H. L. EADES.

South Union, Ky.

The Nebular Hypothesis.

To the Editor of the Scientific American:

Your comments on the "Nebular Hypothesis," page 345, current volume SCIENTIFIC AMERICAN, are very interesting, but I differ from you. I am confident that the equatorial zone cooled first and that the mighty force of that shrinking belt was resisted by no other force. The central mass was

too light and powerless; we cannot rotate an inflated bladder and burst it by the weight of air contained therein, as the air would escape through the pores of the bladder, but we can burst it by the weight of the bladder itself.

If any portion of the nebulæ was left behind, it was the lighter portion, which, owing to that irresistible shrink, spiralled to either pole and like smoke from a pipe streamed on the solar orbit. True, the action of gravitation would be greatest at the poles, but the spiral would reduce it to a minimum, as in a jack screw. Nebulous rings could have formed in no other manner; spheres could have been formed by shrinking belts. THIE.

Paris Green and Potato Bugs.

To the Editor of the Scientific American:

Much has been said, and a great deal written, concerning the use of Paris green for the destruction of the potato bug. Many advise the use of it dry, mixed with flour. Last year, I tried another way, which I think is safer and cheaper; and it proved very effectual. As it may be a benefit to many, I give it as follows:

Take one large table spoonful of Paris green and mix it with ten table spoonfuls of flour. These must be mixed very thoroughly, till the mass is of one shade ofc olor throughout. Take of this mixture, two table spoonfuls, and put it into a gallon of water. Stir this till it is all well mixed through the water, and stir it occasionally to keep it from settling,—for if it is not kept stirred, it will settle. Put the water thus prepared into a sprinkler, and apply when the plants are dry and the larvæ are at work. In a very few minutes, the larvæ will have gone to "that bourne whence no traveler returns."

The liquid applied this way, twice or three times during the season, will be sufficient to protect the plants. Used in this way, while it will destroy the insects, there is no danger of its hurting the plants; nor does sufficient go into the ground to do any harm. X. PERRY MENTOR.

Sans Souci, Ohio.

THE NEW STATE CAPITOL AT ALBANY, N. Y.

After three years labor, and at a cost of two millions of dollars, one third of the new capitol at Albany, the design for which we illustrated on page 242 of Vol. XXIII., may be considered complete. The foundations are laid, and the water table, and four feet of the first story walls, is in position.

The structure covers about three acres of ground, its width being three hundred feet, and its depth, four hundred. The cellar is excavated 26 feet and its floor is covered with a solid bed of concrete four feet in thickness. On this rest the piers of massive brickwork which, surmounted by groined arches, bear the weight of the structure. Long vaulted passages are thus formed which, intersecting each other, traverse the entire cellar, some leading to apartments in the corners of the building, others to the large hall in its center. The last mentioned division of the cellar is designed for an engine room, and is to contain four large furnaces and two engines, to be used for warming and ventilating the edifice. The ceiling of this apartment is, like those of the passages, formed of groined arches. These are 20 feet high, their spans varying from 11 to 20 feet, and are considered the finest specimens of masonry of their kind ever constructed.

The foundation of the main tower is the heaviest piece of solid stone work in the building. It is pyramidal in shape, its base being 150 feet, and its top, 80 feet square. It is sunk six feet below the surface of the cellar, and its extreme strength is necessitated by the immense superincumbent weight of tower which will be constructed entirely of stone and iron, and will reach a hight fifty feet above that of the dome of the Capitol at Washington.

The exterior foundation walls are 20 feet thick; their lower courses are built of a species of blue limestone of great hardness, obtained in Essex county in this State. The upper portions, which are more liable to be affected by frost, are constructed of Saratoga granite, and the lintels, of a very coarse granite from Fall River. The water table is built entirely of Dix Island granite, the company supplying that stone having had a contract to employ it exclusively in that part of the structure. On the completion of the water table and the consequent expiration of the Dix Island Company's contract, new proposals were invited from other quarries to supply the stone for the rest of the building. Sixteen competitors entered, and, in the end, the work was awarded to a company in Yarmouth, N. H., who agreed to furnish the stone at 75 cents per cubic foot delivered at Albany. It seems, however, and the fact will account for the delay in the progress of the work which the daily press have lately made the subject of unfavorable comment, that the Yarmouth Company failed to carry out their contract, sending only some eighteen or twenty carloads of stone around by land at considerable expense. The Keene quarry, of Keene, N. H., offering to supply their stone at 85 cents per cubic foot, the commissioners have agreed to take the balance of the material from that source.

Of these three varieties of granite—the Dix Island, the Yarmouth, and the Keene—the Dix Island is much the coarsest in texture; the Yarmouth and Keene stones resemble each other very closely, both being white, fine, and hard. The Keene, however, is found to be slightly the most brittle under the cutting tool.

The stone is quarried in enormous blocks, some weighing as much as thirty tuns. They are so cut as to make all the angles of the building solid, or, in other words, there is no angle on the outside of the building where two stones meet and form a joint. The manipulation of these ponderous masses was, of course, at first a matter of no slight difficulty, but lately a form of derrick has been devised by which they can be raised or transported from place to place with the utmost facility. The apparatus consists of a heavy platform mounted on trucks and resting on a track, the rails of which are some sixteen feet apart. On this platform is a ponderous crane, secured by strong wooden stays. To the crane, heavy tackles are attached, the falls leading to a hoisting apparatus worked by a five horse power engine, situated on the rear end of the platform. This engine, being geared to the wheels of the latter, supplies the motive power; so that a stone can be lifted by the crane and the whole machine moved bodily to any desired point.

Seven hundred men are now at work upon the building, the majority being engaged in cutting the stone, which is supplied in the rough, into the required forms. Two large sheds serve as workshops, movable derricks running on tracks transporting the stones to any required locality. The work is systematized with the greatest care. Each man is required to work his stone through from beginning to end. The stone is numbered and the work measured, so that it can readily be seen whether the full day's work has been properly performed or not. The hands are paid by the hour. They struck some time since on account of some workmen from another State being put to work with them, and at the same time demanded $4.50 for eight hours work. A short time had elapsed, however, before the union in this city informed them that it could support them no longer, and consequently they compromised at 45 cents per hour, and signed an agreement to find no more fault either in their wages or in the fact of non-union men being put to work with them. When the present excitement commenced, a committee endeavored by threats and other means to induce another strike, but on the wages being raised to 50 cents per hour, the men declared themselves satisfied and refused to resort to any further coercive measures.

A Monster Cannon.

The Russian government has lately constructed and tested an immense smooth bore cast iron cannon, made after the method of the American Rodman guns. The *Engineer* says that the weight of this weapon in a finished state is 44 $\frac{33}{42}$ tuns. The weight of the projectile to be employed—a cast iron spherical one—is 900 lbs. In trying the gun, in all 313 rounds were fired, the normal charge of prismatic gunpowder being about 117 lb. The experiments of firing were conducted on the river Rama, the high bank across the stream serving as a butt, which was at a distance of about 1,400 yards of the gun. The weapon was placed under an iron plated covering of a peculiar construction. On the discharge of the piece, the concussion of the air was so great that in the village of Matoriloro, situated at a distance of one third of a mile, the chimney stacks fell in when the wind was blowing in that direction. The sound itself, although loud, was not deafening, and persons standing even under the iron plated covering were able to support both the noise and concussion of the air. The iron gun carriage weighs 6$\frac{1}{2}\frac{4}{2}$ tuns. The breech of the gun is elevated and depressed by means of a screw ratchet key. For facilitating the running forward of the gun, a system of cog wheels is introduced, and for the diminution of the recoil and the hoisting of the charge and projectiles, special appliances are provided. The moving of this enormous mass of iron can be effected easily by three men.

After the introduction into the military art of rifled cannon, the conviction became established of their unconditional superiority over the smooth bores. As regards guns of small caliber, this opinion may very likely be correct; but with respect to naval guns of the largest calibers, it would be difficult to give the preference either to the one or the other system. Without going into particulars of the merits or demerits of the one or the other description of weapon, we will point to one important difference in the effect of the spherical projectiles of the smooth bores and the oblong ones of the rifled guns; the latter will hit an iron plated target at a greater distance than the former, and, so to say, pierce it through; on the other hand, the former will produce a far greater amount of concussion, shaking loose the rivets of the plates and bolts of the target, and bounding on the plates and cracking them. Besides the difference in the destructive action of these weapons, there is an enormous difference in the cost of production. Thus, for instance, according to a statement of Mr. Grasshof, the price of a 20in. smooth bore gun will be, when produced in quantities, about $8000, whereas an 11 in. steel rifled piece corresponding to the same could not be produced under $30,000.

New Fishing Smack.

A marine novelty worthy of attention was lately exhibited in Glasgow. It was a model of a welled fishing craft, 4ft. long, with 19 in. beam, clinker built and neatly finished. The exhibitor was Mr. Dempster, of Kinghorn, who is well known for his advocacy of deep sea fishing, and who proposes to convert ordinary open decked fishing smacks into well decked boats, by laying a well caulked deck or flooring from stem to stern, at a hight of 2½ft. from the keelson, the space beneath this deck forming the well, which is filled with sea water from several small circular holes in the bottom of the boat. At a hight of 5ft. or 6ft. above the well deck there is another deck, which rises to within a foot of the gunwale, and which, being water tight and comfortable, is adapted for the quarters of the crew. Mr. Dempster has proved the advantages of this style of fishing craft by actual results in practice; and he claims for his system the advantage that, no matter what seas the boat may ship, it is impossible for it to be swamped, as the water immediately makes its way out at the bottom.

New Theory of Atmospheric Electricity.

A correspondent, Mr. G. Wright, of Rock Falls, writes as follows:

"The earth is surrounded by an electrical atmosphere which is subject to the law of gravitation, and is consequently more dense near the surface of the earth, and more rare in the higher regions. All the phenomena of electricity are due to the disturbance of this electrical atmosphere, in connection with the resistance of different substances to the passage of the electric fluid. When any substance has more electricity than another substance near it, it is in a positive or charged condition; when it has less, it is in a negative condition, and the attraction which negative substances exhibit for the positive is only the tendency to restore the equilibrium.

If a bladder be filled with air near the surface of the earth, and then elevated to a considerable distance, the confined air will burst the bladder and escape, because the atmosphere which surrounds it in these higher regions is of less density. So if a metallic ball, having the electrical condition natural to the surface of the earth, be suddenly elevated, its natural electricity becomes a charge, which may be drawn off by a spark. This fact can be demonstrated, on a still day when the air is free from moisture. Now, what better evidence do we want to prove that the earth is surrounded by an electrical atmosphere, more dense near the surface of the earth, and that the charge on the ball which was elevated is due to the lesser density of the electrical atmosphere which there surrounds it? When we add to this the chain of evidence which results from the explanation, of electricity in the clouds, the causes of *aurora polaris*, the daily variation of the magnetic needle, and every other electrical phenomenon, on this hypothesis, the proof is as positive that the earth is surrounded with an electrical atmosphere as that it is surrounded with an aerial one. I have spent several years in experiments and observations to demonstrate the truth of this hypothesis, and upon it to establish a theory that shall be applicable to all electrical experiments and phenomena, and am astonished at the facility with which all questions pertaining to this subject can be solved."

Refractory Clays.

Bischoff finds that the analysis of a clay gives a distinct indication as to its power of resisting extreme heats. The temperatures were measured by keeping the clay at a white heat till wires of iron or platinum were fused. The value of a refractory clay is found by the proportion of the alumina to the fusible matter, and again by that of the alumina to the silica. The more alumina a clay contains in proportion to the fusible matter (iron, alkalies, etc.,) the more refractory is it. Silica, on the contrary, augments its fusibility. Of two clays containing alumina and fusible matter in the same proportions, that which contains least silica is most refractory. Save in certain determinate cases, the clays containing alumina, silica, and fusible matter in equal proportions have an equal power of resisting fire. If we give to clays the general formula—$m\ Al^2 O^3 + n\ Si\ O^2 + RO$, the degree of resistance to fire is measured by $\frac{m}{n}$. The higher the value of this fraction, the more refractory the clay.

PUT UP YOUR JAM WHILE HOT.—It is said that ordinary jam—fruit and sugar which have been boiled together for some time—keeps better if the pots into which it is poured are tied up while hot. If the paper can act as a strainer, in the same way as cotton wool, it must be as people suppose. If one pot of jam be allowed to cool before it is tied down, litttle germs will fall upon it from the air, and they will retain their vitality, because they fall upon a cool substance; they will be shut in by the paper, and will soon fall to work decomposing the fruit. If another pot, perfectly similar, be filled with a boiling hot mixture, and immediately covered over, though, of course, some of the outside air must be shut in, any germs which are floating in it will be scalded, and in all probability destroyed, so that no decomposition can take place.

HYDROFLUORIC ACID.—Mr. A. P. S. Stuart remarks that every one who has prepared hydrofluoric acid knows that sulphuric acid and fluor spar form an exceedingly hard, rock-like compound, and that it is very difficult to remove this from a platinum retort. The inconvenience may be avoided by mixing with the fluor spar about an equal weight of gypsum and the proper quantity of sulphuric acid. After the hydrofluoric acid has been expelled by heat, the mass in the retort is found to be of a pasty nature, and is easily removed by water.

FATHER CLEVELAND.—Charles Cleveland, a respected clergyman of Boston, Mass, widely known for his useful and faithful labors, died recently in that city, at the remarkable age of one hundred years—less sixteen days. He retained his faculties up to the moment of his death, and continued in the exercise of his peculiar ministrations as city missionary until within a few weeks. After attaining his majority, he spent forty years in mercantile pursuits. His work for the past forty years has been remarkable. He devoted his whole time to ministering to the poor, and his labors were highly appreciated.

STRETCHING OF CHAINS.—Professor Trowbridge, of Yale College, has stated that at the Novelty works, N. Y., he once made a chain one thousand feet long, to be used for pulling a load of ten tuns up an incline five hundred feet long and one hundred feet high. In one year he took out, little by little, sixteen feet of slack caused by stretching. The chain got stretched out in time, though, and then did not alter.

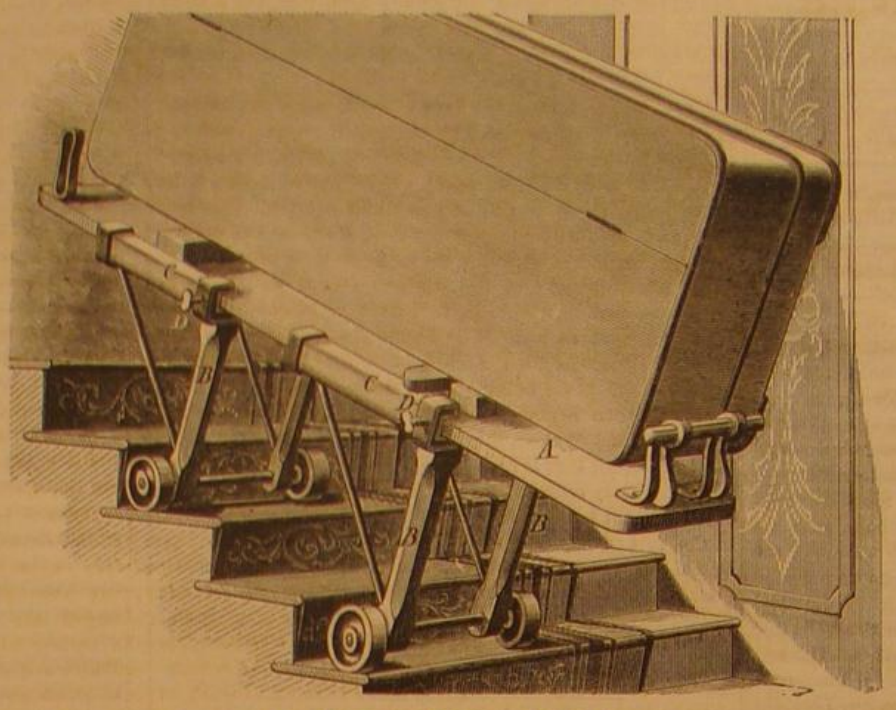
Improved Piano Truck.

The improvement we illustrate consists in making the trucks adjustable in regard to the bed which carries the load, so that they can be fixed at any required distance apart, by which means they may be fitted to stairs of various forms, and used to run pianos, or other heavy goods, up and down them. They are also readily detached from the bed when required, to facilitate loading or unloading.

Our engraving represents the improved truck while conveying a piano up (or down) stairs.

A is the bed, which is furnished at one end with the handle shown, and at the other with two straps, one of which is seen in the engraving. It is also furnished with four cushions, two fixed and two adjustable, on which the piano rests; three of these are partly shown between the bed and the piano. The trucks, B, are provided on both sides with grooved slides, as at C, by means of which they are made to travel on, along, or off the bed, A. They are fixed to the bed in any desired position by the screws, D.

In ascending or descending stairs the trucks are adjusted to the position shown in the drawing, so that, when one pair of truck wheels are snug against the riser of one stair, the other pair are rolling on the tread of another. By this adjustment one pair of wheels is always in position to be raised or lowered to the next stair. When required to put the piano into a wagon, the truck is raised by the straps until the handle end touches the ground, the piano resting on the handle; the upper truck is next slid off the front of the bed, which is then let down into the wagon; the other truck is then removed, and the bed and piano slid in. In taking it out, the bed is pulled out far enough to have one of the trucks put on it; the inner end is then raised until the outer end rests on the ground, when the other truck is put on; it is then gently lowered until the bed stands on all four wheels. While moving the piano over floors, sidewalks, etc., the spring of the bed between the cushions on which it rests prevents all jar to the instrument.



FRENCH'S PIANO TRUCK.

Altogether this seems to be a very useful as well as an ingenious invention. It is protected by patents issued March 16, 1869, and September 19, 1871. Further information may be obtained of the inventor, Mr. Charles A. French, of Davenport, Iowa.

Sawing, Boring, and Planing Machine.

The invention we illustrate supplies workers in wood with a useful machine that can be readily adjusted for service either as a scroll saw, a circular saw, a planer, or a boring machine, and which may be run by hand or by power, as desired. Its most important feature is a skillful and effective contrivance by which the speed is multiplied and the power conveyed from the driver to the tool.

The machine is represented in Fig. 1, and Fig. 2 shows, in detail, the peculiar arrangements of pulleys and belting for conveying the power, etc. A is the driving pulley or drum. B are belts which pass around it, and around the loose pulleys, C. These belts are drawn inward, on opposite sides, as shown in Fig. 2, so as to surround the shaft or small pulley, D, and communicate motion to the same. The loose pulleys, C, run on a shaft attached to the upper ends of two levers, one of which is partly shown in Fig. 2; the lower ends of the levers are connected by a cross-bar, to which is attached a strap that admits of being secured to the frame of the machine, as shown in Fig. 1. By this arrangement the tension of the belts is adjusted. The shaft, D, extends across the frame, and carries at its outer end the fly wheel, E; this is attached by a pin to a connecting rod which gives motion through a crank to the rock shaft, F, the crank being adjusted so that the revolution of the fly wheel only rocks the shaft. This motion of the rock shaft is conveyed through slides to the scroll saw, causing it to make its downward stroke; the recoil is secured by the band, pulleys, and spiral spring seen at the top of the machine.

To the shaft, D, may be attached a circular saw in the ordinary manner, and to its inner end (not shown in the engraving) a cutter head, suitable for light planing or molding, or a boring tool, may be affixed. The table is provided with gages, and is adjustable to any elevation required by the character of the work. Our engraving shows both scroll and circular saw attached to the machine, but, in practice, when the scroll saw is used, all the other tools should be detached from the shaft; and when either circular saw, planer, or boring tool is employed, the crank pin of the fly wheel should be detached from the connecting rod, and the operation of the scroll saw prevented. The position of the belts on the pulley or shaft, D, puts equal pressures on opposite sides of the same, and does away with all side strain. Almost the entire periphery of the shaft is in contact with the belts, and a very large surface contact, as compared with the size of the shaft, is obtained. This, and the absence of the usual intermediate belts and pulleys employed for attaining speed, insure the utilization of the power applied and prevent its waste. We are informed that the hand power machine has been employed to saw three inch hard oak felloes and other carriage work with perfect success. It is manufactured extensively by the Greenwich Mowing Machine Company, of Greenwich, N. Y., of whom further information may be obtained.

Patented through the Scientific American Patent Agency for the inventor, Mr. William Weaver, October 3d, 1871, and January 30, 1872

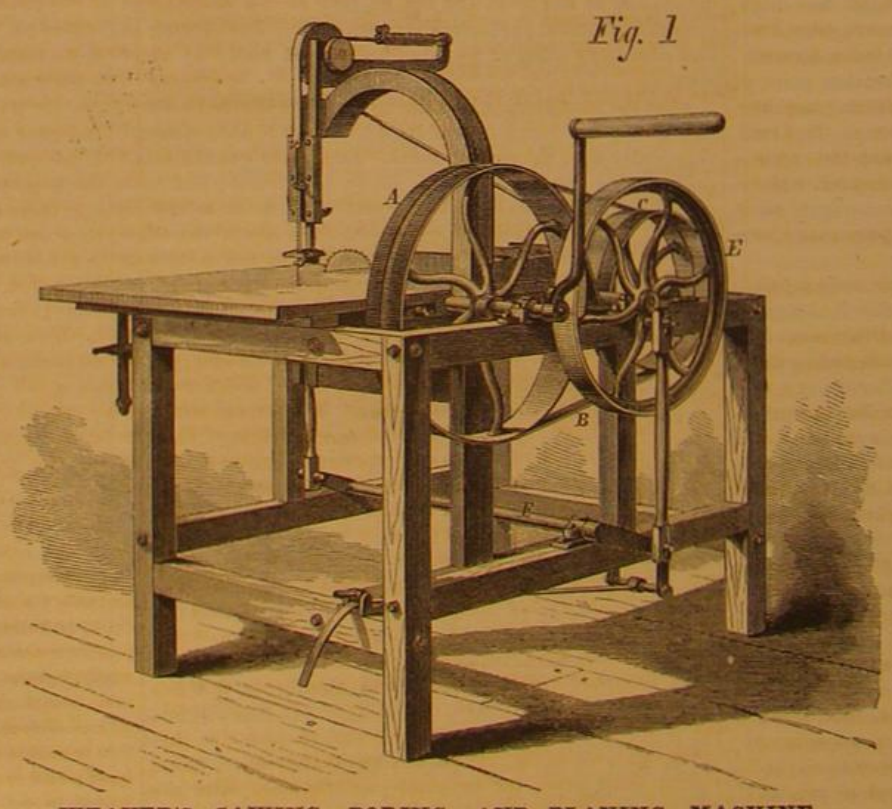


Fig. 1

WEAVER'S SAWING, BORING, AND PLANING MACHINE.

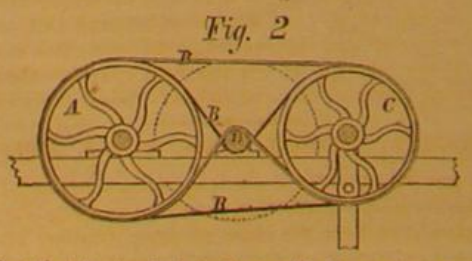


Fig. 2

Impurities in the Air.

Carbonic acid is not a poison by reason of any action on the blood. When it is present in the atmosphere in large amount, the glottis spasmodically closes, and death ensues from asphyxia. When in small proportion, it is still not taken into the system, but it interferes, to the extent of its presence, with the absorption of oxygen, and the elimination by respiration of the blood. Essentially, therefore, its action is that of a ligature to the trachœa. Thus I put this mouse into a jar of pure carbonic acid gas, and you observe that the animal dies in a few seconds. This other I place in an atmosphere containing forty per cent of carbonic acid, and death takes place after a longer interval, but still in essentially the same manner as in the first instance. If, however, as in the next experiment, I remove the animal before death takes place, and expose it to a free current of atmospheric air, recovery follows very promptly. It is hence apparent that carbonic acid gas is not a directly poisonous substance, but that it simply interferes with the performance of processes which are essential to life. When its influence is removed, provided the animal is not *in articulo mortis*, respiration goes on again as in health; just as, when a man hangs himself, and is cut down before life is extinct, recovery can generally be effected.

Phosphuretted hydrogen—a form of phosphide of hydrogen—is given off from all animal bodies, and especially fish; phosphorus abounding in these animals. It is the element which renders luminous the emanations from decomposing substances, and is frequently seen in the form of masses of luminous vapor over graveyards and other places where phosphorized bodies are undergoing decomposition. It is exceedingly poisonous, and acts with great energy on the living animal body when absorbed into the blood through respiration.

Sulphuretted hydrogen is still more poisonous, and is a constant emanation from decomposing animal matter. Dupuytren found that $\frac{1}{800}$ part of this gas in the atmosphere was sufficient to kill birds in a few seconds. In my own experiments, I found that small animals died after a few minutes when the $\frac{1}{1000}$ part of sulphuretted hydrogen was present.

As you see now, I place this mouse under a large bell glass, and introduce a very small amount of sulphureted hydrogen. The animal dies quietly, after an exposure of less than five minutes.

This was probably the chief agent in causing death in several cases which have occurred in churchyards and dissecting rooms.

The ammoniacal compounds and carbureted hydrogen are also highly deleterious, and when inhaled in concentrated forms are speedily fatal.

But, besides these, there is reason to suppose that there are present, in the atmosphere contaminated with animal emanations, certain living organisms.

The Diamond Fields of South Africa.

On the geological questions connected with these diamond fields, Mr. John Paterson has propounded some new views based on a minute and careful examination of the appearances which presented themselves to him on a visit to the diamond fields. He discredits the theories which would refer the presence of diamonds in Grequaland West to any distant sources, and thinks the evidence incontestable that the marl soil, as he named it, in which the gems are now found, is the true matrix soil of the diamond. This marl soil, he considers to be the metamorphosed carboniferous shales of the country, and the change which has worked upon these shales, by which they have been transformed from the black carboniferous shale into the whitish ashy marl in which the diamonds are found, he attributes to intrusions of greenstone trap, which traverse the country from N. E. to S. W. in continually recurring dykes. Mr. Paterson gave some very interesting details of the extent and richness of the diamond diggings in South Africa, and in his picture of the Gong-Gong and Delport Diggings as "Great Rushes" in diggers' phrase, resembling in extent and richness Colesberg Kopje, but now nearly worked out, not by the hand of man in a few years, but by the angry waters of the Vaal River through many ages he found much groundwork of hope that the diamond discoveries of South Africa are to be no fleeting passing industry, but a continuous employment, not only for many years but for many ages.

Testing Burning Fluids.

Pethuel Millspaugh of Kent, Conn., has obtained letters patent for an improved test for burning fluids.

This invention provides an improved instrument for testing kerosene oil and other illuminating fluids, and also for determining the specific gravity of fluids generally. The apparatus consists of an upright glass cylinder which is supported in the top of a chamber formed in the upper part of the base. A lamp is placed in the base, the heat from which is transmitted through the chamber to the lower part of the glass cylinder, and the chamber may be made to contain air, water, etc., as required to regulate its intensity. The glass cylinder contains a thermometer, which is fixed therein, and is closed at the top with a brass cover. The burning fluid to be tested is made to completely fills the glass cylinder, so that the thermometer is entirely submerged, and cannot be affected by the surrounding atmosphere. An orifice in the brass cover is opened to allow the escape of vapor from the fluid under test, and, when necessary, the lamp is lighted. A flame is held over the orifice, and at the moment the evolved vapor is ignited the temperature of the fluid is corectly indicated by the thermometer. In ascertaining specific gravities by this instrument a hydrometer is also placed within the glass cylinder in such a manner that its scale tube is free to move up or down through a hole in the brass cover. The surface of the fluid tested is plainly visible through the glass cylinder, and the scale may be accurately read.

QUICKSILVER has been found near Austin, Texas.

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A NEW PATENT LAW IN CANADA.

We have the pleasure of announcing that the Parliament of the Dominion has just passed a new patent law, which, among other judicious provisions, grants to American citizens the privilege of obtaining patents in Canada on very favorable terms.

We hail the passage of this law as an indication of real progress on the part of the people of Canada. Its practical operations can hardly fail to prove advantageous to the material interests of the Dominion.

A valued correspondent in Canada furnishes the following *resumé* of the provisions of the new law, which goes into effect on the first day of September next:

The law provides that all inventors, or their assigns, may receive patents, provided a foreign patent for the invention has not been in existence for more than one year prior to the application being made for the Canadian patent. Improvements on existing patents may also be patented.

The applicant shall, for the purposes of the act, elect his domicile in some known place in Canada—this being a mere formality.

The patent will be issued for five, ten, or fifteen years, at the option of the applicant; but, at the expiration of the first five or ten years, the patent may be extended for another term of five years; there is no provision for extension after the fifteenth year.

In case of error or defective description, the patent may be reissued, as is the case in the United States.

In case of an assignment of a patent, such assignment must be registered in the Patent Office.

The law provides for remedy in case of infringement of patents—and also for the impeachment of patents before the courts.

Every patent will be subject to the condition that the patentee shall manufacture the invention in Canada within one year from the date of the patent; and the patent is to be void if, after the expiration of one year from its date, the patentee or owner causes the importation in Canada of the invention for which the patent is granted.

The fees payable to the Patent Office for each patent are at the rate of $20 for each period of five years. When the patent is refused, half the fees may be returned to the applicant. This rule is always acted upon.

Inventors may file caveats, to be kept secret and of record for one year.

Patents may be refused when the alleged invention is not patentable in law, or when it is already in the possession of the public, or when there is no novelty or utility in the invention, or when it has been described in a book or printed publication, or when it has already been patented in Canada, or elsewhere by the inventor for more than one year previous to the application.

When a patent has been refused, appeal lies to the Governor in council within six months after notice of such refusal.

In case of interfering applications, the case may be referred to three arbitrators, one to be appointed by each applicant and the third by the Commissioner of Patents—their decision to be final. The fees of arbitrators to be a matter of agreement, except those of the arbitrator appointed by the Commissioner, which are to be paid equally by both parties.

Patented articles are to be stamped as such, and a fine of $200 is imposed for false marking.

By reference to a card in another column, it will be seen that Messrs. Munn & Co. are now ready to receive applications for patents in Canada.

PROGRESS OF THE EIGHT HOUR STRIKE.

The many acts of violence, to which the workmen supporting the eight hour movement in this city have taken recourse, seem to have culminated in the shooting of James Brownlee, a carpenter and non-society man, who was quietly at work in a shop on Forty-first street, near First avenue. It appears that two of the strikers threatened him with personal assault if he did not at once quit work and join them in the strike. Fearing that they would carry out their threats, Brownlee left the shop and passed into the street, when one of the men who had followed him drew a revolver and shot him through the cheek, saying at the same time "That's the way we treat such as you are." This atrocity, although promptly disavowed and condemned by many of the organizations, has produced a powerful effect on the community at large, and has resulted in a marked diminution of public sympathy for the cause. The threats of abandonment of work, on the part of the men employed at the gas works, have caused, during the past few days, considerable apprehension throughout the city lest the streets at night should be left in darkness, but the danger has been happily averted by the gas companies acceding to the terms demanded.

The small number participating in the procession, which was intended to exemplify the great strength of the movement, has been a source of disappointment to its advocates. The working men for some reason viewed the idea with disfavor, so that, instead of an army of thirty thousand men, barely twenty five hundred paraded through the streets. There was no disturbance along the route, nor any cheering, but simply a lack of enthusiasm which fell like a pall on the sanguine expectations of the strikers. During the remainder of the past week, the desertion and returning to work of a large number of employees of Singer's sewing machine factory has rendered the movement still weaker; and although a considerable number of men still hold out, it is the general belief that it must eventually fail.

Advices from out of the city inform us that the strike is but little felt, and that its effect has been rather beneficial to manufacturers in other States. The reason is that the better class of workmen who have no sympathy with the movement find themselves compelled by the action of their trades' unions to leave the city and obtain labor elsewhere, while the malcontents throughout the country flock to New York in hopes of getting increased wages.

On the part of the manufacturers, the position adopted in the beginning has been steadfastly maintained. The piano forte makers publish a series of resolutions which clearly and forcibly define the stand they have taken. They state that, in case they are forced to raise the price of the goods thirty-three per cent, they cannot compete with the makers in other parts of the country, in whose productions there has been no corresponding advance. Nor, since the trade in the smaller sizes of pianos is mainly local, can they afford to raise the price of their instruments, as the cost of an ordinary piano would then be so great as to be without the reach of a large majority. As far as this branch of manufacture is concerned, it is claimed to be evident that concession to the terms demanded by the working men is absolutely impossible; and we have been assured by the leading firms in the city that if they did yield to the exactions of the strike, the result then would be no worse than if they abandoned their business and sought investment for their capital elsewhere.

The carriage makers, although forming no combinations among themselves, agree in substance with the views of the pianoforte men. The proceedings of the workmen from the establishment of Brewster & Co., of Broome street, are the most incomprehensible of the many vagaries to which the strike has given rise. This manufactory has been carried on on a coöperative principle; that is, the employees owned an interest in the profits of the business. They were fully represented in the management of the internal economy of the concern, had a voice in the regulation of their own pay and hours of labor, and received dividends proportioned to the amount of wages paid them. Three days before the strike they declared themselves satisfied with the existing arrangement, and actually, as we are informed, refused to vote themselves eight hours as a day's work. In spite of all this, suddenly, at the instigation of a few malcontents among their number and intimidated by the trades' unions, they joined the strikers, and, in addition to leaving their work, deliberately forfeited a dividend of several thousand dollars, which was shortly to fall due them.

As to the final result of the movement, we consider that there is but little doubt. Want of support from other cities, the firm front presented by employers, together with the convictions, which are evidently being brought home to the minds of the more intelligent workmen, of the impracticability of the scheme, will end in its abandonment.

It is our belief that coöperation is the most efficient means by which the laboring classes can hope to secure the privileges which they now claim as rights.

WEIGHT, PRESSURE, FORCE, POWER, WORK.

The fact that the above words are often confounded together, for the simple reason that their true meaning is not well understood, has been the cause of many fruitless attempts at mechanical inventions and improvements. Most searchers for perpetual motion make no distinction between pressure and force, and are under the delusion that mere pressure can produce work, and we have seen writers on mechanics and we have even heard lecturers on scientific subjects speak of a force of, say, two tuns weight. Weight alone is not force, neither is pressure equivalent to work; and it may therefore be useful to attempt some clear definitions of the above terms, in order to protect inventive minds against mistakes in mechanical reasoning.

Weight is simply the measure of an amount of matter referred to a certain standard accepted as a unit. This unit may be a gramme, a pound, a tun, or our whole earth, which the astronomers use; but, in either case, it conveys to the mind nothing but the conception of an inert mass, or a certain amount of matter, for the determination of which gravitation gives us the means of measuring and comparing. Therefore we may say: To have "a mass of two tuns," but not "a force of two tuns."

Pressure is a result of this gravitation, and a mass of two tuns will exert a pressure of two tuns; in this way, we may estimate the effect of a spring, hydraulic press, or other similar contrivance, by saying its pressure (not its power) is equal to two tuns, meaning thereby that it has the effect, on the material to be pressed, as if two tuns weight were placed upon it; but we have in pressure neither force nor power. These conceptions of the latter require other elements, as we shall soon see.

Force is matter in motion, nothing more, nothing less; the abstract idea of force without matter is a nonentity. All the modern discoveries in science tend to prove this more and more plainly. Without matter, force would have no existence, but it may be hidden in matter as molecular invisible motion in the form of heat, electricity, etc. The steam engine, electromagnetic engine, etc., are there to prove how this molecular motion, or hidden force, may be changed into visible force or motion of matter. Inversely, the caloric friction machine changes motion into heat; the ordinary and also the Holtz electric machine change motion into electricity. In any case, we are driven to the conclusion that all force proceeds from motion of matter, and is finally resolved into motion of matter, either of masses, or into molecular motion, generating one of the so-called imponderable forces.

Chemistry has proved since the last century that the amount of matter in the Universe is a constant invariable quantity, and that we cannot create or destroy a single material atom, but can only change its form from solid to liquid or gaseous, or *vice versâ*. So the modern philosophy of mechanics proves that the amount of force (that is, motion of matter) in the Universe is a constant quantity, and that we cannot create or destroy the slightest amount of this force, but can only change it from mass motion to molecular motion, that is, heat, electricity, etc., or *vice versâ*.

The measure of force is thus the product of the mass with the distance through which it moves; and as the unit of measure of ordinary masses is the pound, and of distances, the foot, we have adopted the foot-pound as the standard unit of force, meaning "one pound *lifted against gravitation* one foot," not "one pound moved one foot," as we have seen and heard it stated, which of course gave rise to the most absurd calculations in regard to the immense power obtained to drive a steamship or railroad train.

If one pound weight is raised one foot, one unit of force is expended; if, inversely, we cause one pound to descend one foot, we obtain a unit of force back, and may transform this into other mass motion, or into molecular motion. We may cause this mass of one pound to be raised slowly if we have little power to apply, or rapidly if we have greater power; and, inversely, we may cause it to descend slowly, as is done in the weight of a clock, and spend itself gradually during a long period of time, producing slight effects throughout that time; or we may cause it to descend quickly, as is the case with the blow of a hammer, and spend itself during a very short period of time, almost instantaneous, producing a powerful effect for that short time. So the driving in of a nail, which often the pressure of a tun weight would not accomplish, the blow of a hammer of one pound, lasting a small fraction of a second, will accomplish easily. This remark points out forcibly the difference between the weight of masses at rest and of masses in motion, in other words, the immense difference between mere pressure and force.

RUBBER GRAPHITE PAINT.

A waterproof paint, for metal roofs, fences, bridges, ships, and every kind of wood structure, which, at the same time, could be relied upon to reduce the corrosive influences of exposure to the atmosphere, is an article for which the demand would appear to be almost without limit. A patent has just been issued, through the Scientific American Patent Agency, to Mr. Samuel F. Mathews, of Harrisburg, Pa., on an invention intended to meet the wants of the community in this respect; and from the ingredients he uses, we think his paint will answer a good purpose.

The rubber graphite paint is a solution of pure india rubber in linseed oil, which is ground with graphite into a thick, elastic, smoothly flowing paint. Compositions of which india rubber forms a part possess in the most eminent degree the quality of resisting the action of moisture and of corrosive gases carried in the air. In the graphite, we have a pure form of carbon; and it appears to be well known that paints containing carbon in any form last longer than other kinds not having it as an ingredient—holding their body and color when the other paints are totally destroyed. We do not see why this compound, combining as it does these two valuable elements, should not form a paint of great durability and highly protective qualities.

All shades of color from black to gray, or cream color and the drabs, can be made as desired. A company under the

title of the Rubber Graphite Paint Company has been formed, and has commenced the manufacture of the article at Harrisburg, Pa.

Facts for the Ladies.—Miss S. A. Davis, Berlin, N. Y., has used Wheeler & Wilson's Lock-Stitch Sewing Machine 17 years in collar making; supported herself and an invalid mother, whom she also tended, and has saved over $2,000; she has been a constant worker by foot power and not sick a day. See the new improvements and Woods' Lock-Stitch Ripper.

Whitcomb's Remedy for Asthma is one of the best medicines in use.

Facts Worth Knowing.—The New Wilson Under-Feed Shuttle Sewing Machine is to-day the simplest, most perfect, most easy operating, best made, most durable, and, in every way, most valuable Sewing Machine in existence, and it is sold fifteen dollars less than all other first-class machines, on easy terms. Salesroom, 707 Broadway, New York; also for sale in all other cities in the United States.

Notes & 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.]

1.—Ocean Cables.—I would like to know if the Atlantic cable lays on the bottom of the ocean? Or if it is only part of the way down, what keeps it there?—H. F. B.

2.—Lard in Tin Cans.—Is lard injured by being stored in bright tin cans? If so, what is the chemical action which causes the injury? W. H. C.

3.—Plaster Casts from Dead Bodies.—I wish to know how to take a plaster of Paris cast of a tumor on a face, so as to represent the face and the tumor? What will give to the plaster a glossy finish? I can take a very good cast, but fail to get as good a finish as I have seen.—J. A. D. Jr.

4.—Paint for Iron.—Can any one inform me if there is any substance that can be applied easily, say with a brush or otherwise, in a thin coat to iron, that will stand heat to redness without melting, peeling off, or cracking?—E. J.

5.—Cement for Letters on Glass.—How are the gilt letters put on glass signs, so as to have the polished appearance that all such gilt letters do? The painters here do not know how to do it, although one of them is a subscriber to the Scientific American.—J. F.

6.—Separation of Oils.—By mistake one barrel raw linseed oil and one barrel West Virginia lubricating oil got mixed in our oil tank. Is there any means of separating the two oils?—R. K.

7.—Dimensions of Belt.—Can any one of your readers inform me what width of belt I require to convey one, two, or three horse power?—W. J. S.

8.—Weevil.—What will prevent the weevil getting into Indian corn? What will exterminate it from a lot of corn, shelled and in bags? How long will the corn keep safe from getting musty, when stored in open casks or common grain bags in piles, the bags standing on end on floor?—J. B.

9.—Gold Solution.—Will the gold solution to be applied by brush, mentioned in Scientific American, Vol. XXVI. page 289, adhere on the plating of buggy dash rims or harness mounting, as on iron or steel not so plated? If so, how long will it retain its brilliancy? Will it not soon come off? How are the mountings of harness plated with gold or silver? Must a battery be necessarily used in such plating, whether white or golden? —J. B.

10.—Test for Zinc.—What is the best test for zinc in wells where galvanized pipes are used? What per cent or how many grains in a gallon of water is sufficient to injure health?—J. B.

11.—Slack Coal and Saw Dust.—At our saw mill, coal is used under the boiler; and upon exposure to weather, it slacks and, unavoidably, we have much coal dust, and of course we have much saw dust to spare. Is there any way to utilize them, and so reduce the cost of our fuel? A way that would not be very expensive—all the machinery and parts of the process being of home manufacture—is needed.—J. F. T.

12.—Metal Lining in Cast Iron Vessels.—How can I prevent the lining metal in cast iron boxes from becoming loose? After they have run some time, the lining becomes loose, and I have to refill them. Would tinning the boxes prevent the metal from getting loose? If so, what would be the best process to tin boxes that are cast on the frame so that they cannot be removed The lining metal used is Babbitt's metal, *minus* the antimony.—W. A.

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.

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Wanted—Descriptive price list and catalogue of *new* and second hand fire engines, hose carts, and hose. Ad. Trost, Neb. City, Neb.

For Machinists' Tools and Supplies of every description, address Kelly, Howell & Ludwig, 917 Market Street, Philadelphia, Pa.

Stencil Tools, full set, $5. Circulars free. J. T. Lee, Warrenton, Ga.

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Wanted—A man who thoroughly understands how to Finish Harness and Roller Buckles and to make the Dies which form the Tongues. Good wages and steady employment. For further particulars, address with name and residence to B. K. Murphy, cor. 28th St. & 7th Av., New York.

Three fourths saving of fuel, by the Ellis Vapor Engine (Bisulphide of Carbon) in running the Haskins Machine Co's Works, Fitchburg, Mass. To whom apply.

State Patents for Sale—Black's Improved Fertilizer, made on the farm at comparatively small outlay of cost and labor. For circular, terms, &c., address G. R. Black & Co., Box D., Donaldsville, G. & C. R. R., S. C.

Wanted—Situation as Mechanical Draftsman. One in the West preferred. Specimen work shown and references given. Address Box 299, Yellow Springs, Green Co., Ohio.

Old Furniture Factory for Sale. A. B., care Jones Scale Works, Binghamton, N. Y.

A Great Curiosity. See advertisement on page 421.

The Patent Vertical Portable Engine—Safer than the Safest—Wear and Tear, none. Power Plenty. Light on Fuel. Griffith & Wedge, Zanesville, Ohio.

The Best Saw Mill in the Market—with Cut Gear Lever Head Blocks and Handsby's Patent Roller Set—makes more and truer Lumber, with less hands to the Mill, than any other Circular Saw Mill in the country. Griffith & Wedge, Zanesville, Ohio.

Stationary Engines—25 Horse Power—for Saw or Grist Mills, ready to ship. Address Griffith & Wedge, Zanesville, Ohio.

Wood Cutting by Electricity—Communications on this subject can be addressed to the patentee, G. Robinson, Box 2622, Post Office, New York.

Write for Chemicals, Crude Materials, and Drugs for Manufacturers' use, to L. & J. W. Feuchtwanger, 55 Cedar Street, New York.

Steel Castings to pattern, strong and tough. Can be forged and tempered. Address Collins & Co., 212 Water Street, New York.

The Waters Perfect Steam Engine Governor is manufactured by the Haskins Machine Co., Fitchburgh, Mass.

Wanted—A first class Sewing Machine Repairer. T. Shanks, Baltimore, Md.

Galvanized Slating Nails, Stove Reservoirs, and Hollow Ware. Address Cleveland Galvanizing Works, Cleveland, Ohio.

Second hand Iron Planer, to plane 9 feet long, 33 inches wide—good as new and cheap. Chas. Place & Co., 60 Vesey St., New York.

Wanted—A partner in the Machinist and Foundry business, well established at Minneapolis, Minn. Address Chas. M. Hardenbergh.

Portable Baths. Address Portable Bath Co., Sag Harbor, N.Y.

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The Shive Steam Engine Governor—Guaranteed to be the best in the world. Circulars sent free. Shive Governor Company, 12th and Buttonwood Streets, Philadelphia, Pa.

For the best Foot Power Jig Saw, address Goodnow & Wightman, 23 Cornhill, Boston, Mass.

For hand fire engines, address Rumsey & Co., Seneca Falls, N.Y.

T. Shaw's Steam Gauges, Ridge av. & Wood st., Phila., Pa.

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Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrew's Patent, inside page.

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Tested Machinery Oils—Kelley's Patent Sperm Oil, $1 gallon; Engine Oil, 75 cts.; Filtered Rock Lubricating Oil, 75 cts. Send for certificates. 116 Maiden Lane, New York.

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Peck's Patent Drop Press. Milo Peck & Co., New Haven, Ct.

The "Bellis Patent Governor," made by Sinker Davis & Co., of Indianapolis, Ind., is acknowledged to be the most perfect engine regulator now in use.

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Williamson's Road Steamer and Steam Plow, with Rubber Tires. Address D. D. Williamson, 32 Broadway, N. Y., or Box 1809.

For the best Recording Steam and Indicating Gauges, address The Recording Steam Gauge Co., 91 Liberty Street, New York.

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

Belting as is Belting—Best Philadelphia Oak Tanned. C. W Arny, 301 and 303 Cherry Street, Philadelphia, Pa.

Boynton's Lightning Saws. The genuine $500 challenge. Will cut five times as fast as an ax. A 6 foot cross cut and buck saw, $6. E. M. Boynton, 80 Beekman Street, New York, Sole Proprietor.

The Baxter Steam Engine is safe, and pays no extra Insurance.

An inducement.—Free Rent for three months to tenants with good business, in commodious factory just built for encouragement manufacturing. Very light rooms, with steam, gas, and water pipes, power elevator, &c. &c. Manufacturers' Corporate Association, Westfield, Mass. Plans of Building, Room 22, Twenty One Park Row, N. Y.

To Ascertain where there will be a demand for new Machinery, mechanics, or manufacturers' supplies, see Manufacturing News of United States in Boston Commercial Bulletin. Terms $4.00 a year.

Millstone Dressing Diamond Machine—Simple, effective, durable. For description of the above see Scientific American, Nov. 7th 1868. Also, Glazier's Diamonds John Dickinson, 64 Nassau st., N. Y.

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Recent American and Foreign Patents.

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

[Medical Compound.—John Frechette, of Chicago, Ill.—This invention furnishes an improved medical compound or tonic bitters for invigorating the system when reduced or weakened by sickness. In preparing the compound are taken one pound of orange peel, three quarters of a pound of calamus, one quarter of a pound of ginger, one quarter of a pound of bayberry bark, and four lemons. These ingredients are ground and put into two gallons of pure spirits, diluted to not less than seventy-five per cent of spirits. The compound is allowed to stand for thirty-six hours in a warm place, and is then reduced to forty per cent of spirits, sweetened to taste with crushed sugar sirup, and filtered. It is then ready for bottling for use or for market.

Velvet Reel.—Peder Jürgens, of St. Paul, Minn.—This invention consists of a pair of oval or cylindrical blocks of wood and another block, of square or other form, placed between them, with a wide board attached to each end of the blocks so as to form a reel. On this reel, velvet ribbon is wound by fastening one end to a pin in the central block and whirling the reel on a pivot at the lower side which may be placed on the counter. The reel is whirled by a handle or key affixed to the upper side, and the pin is so placed in the central block that it will not penetrate the layers of ribbon as they are wound on.

Rotary Puddling Furnace.—Joseph Davies, of Knoxville, Tenn.—In this invention, the revolving puddling furnace is mounted on rollers and rotated in the ordinary manner; it has a large central opening at one side to receive the fire from the combustion chamber, to which it is closely fitted, and another opening on the other side discharging into the flue which leads to the chimney. A flat puddling table is placed upon one part of the interior wall of this puddling furnace, with a hole through the side of the cylinder, arranged in such relation to the table as to allow of balling the metal on it in small balls adapted to be worked into blooms in the squeezer at one operation, the same as it is balled in the stationary furnace. A passage through the flue provides for removing the balls.

Dog for Saw Mill.—Denison Chase, of Orange, Mass.—This invention relates to apparatus used in saw mills for holding logs to be sawed. The dog consists of a bed plate fixed to a head block, to which is attached a slotted upright, against which the log rests when partly sawed. In rear of the upright is a stand or round bar which carries the dog proper. This stand is attached rigidly to the bed plate, and the dog is fitted to it so that it will slide up and down on it. In either direction from the central sleeve of the dog are two arms, each furnished with a claw or finger for entering the log. The dog slides up and down in the slot of the upright, and when not in use is raised above the upright and turned round out of the way.

Hydrostatic Safety Lamp.—Hampton S. Whitfield, of Tuscaloosa, Ala.—This invention relates to that class of well known lamps where the oil is forced up by another liquid. The body of the lamp consists of an upper reservoir, a lower reservoir, and a connecting neck or partition. The neck has two holes formed through it, one to receive a pipe which extends nearly to the bottom of the lower reservoir, and the other to receive a flattened tube which extends up to the top of the upper reservoir, and which is designed to receive the elongated flattened wick tube attached to an ordinary burner. The lower end of the tube projects a little below the bottom of the neck or partition that separates the upper and lower reservoirs, so that there will always be a stratum of air in the upper part of the lower reservoir which cannot escape, and which keeps the oil from penetrating the partition.

Spring Bed Bottom.—Donald McMurchy, of Jeffersonville, Ind.—This invention furnishes an improved spring bed bottom, simple in construction, effective in operation, and durable. The posts, side rails, and end rails of the bedstead are as ordinarily constructed. To the inner sides of the end rails are attached bars in which are formed notches or sockets to receive the ends of spring slats. Each spring slat is placed between and connected with two slide slats which should also be elastic. The side slats are made of such a length that when pressed downward their ends come in contact with and rest upon the bars. Various appliances, which cannot be explained in detail, are added to keep the slats in position. With this construction, should the central spring slats become permanently bent or set they may be removed and reversed, making the bed bottom again as good as new; light weights will be supported by the elasticity of the central slats, but heavy weights will bring the ends of the side slats into contact with the bars, so that the weight will be supported by the elasticity of the three slats, the bed bottom being thus equally easy and elastic, whether supporting light or heavy weights.

NEW PATENT LAW IN CANADA.

By the terms of the new patent law of Canada (taking effect September 1st, 1872) patents are to be granted in Canada to American citizens on the most favorable terms.

The patent may be taken out either for five years (government fee $20), or for ten years (government fee $40) or for fifteen years (government fee $60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

In order to apply for a patent in Canada the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with Munn & Co., 37 Park Row, N. Y., who will give prompt attention to the business and furnish pamphlets of instruction free.

Messrs. Munn & Co., have had twenty-five years experience in the business of obtaining American and Foreign Patents for inventors; they have special agencies in nearly all countries where patents are granted. Moderate charges and prompt attention may always be expected.

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[OFFICIAL.]

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EXTENSIONS REFUSED.

20,447.—WHITEWASH BRUSH.—D. W. Shaw, W. Magraw.
20,492.—PLATFORM SCALES.—J. F. Keeler.
20,515.—HARVESTING MACHINE.—W. H. Seymour, D. S. Morgan.
20,522.—GRAIN SEPARATOR.—A. J. Vandegrift.

DISCLAIMERS.

20,503.—BREECH LOADING FIRE ARM.—G. W. Morse.
2,182, whole No. 33,186.—THRASHING MACHINE.—D. M. Cochrane.

DESIGNS PATENTED.

5,911.—CARPET.—T. Barclay, Lowell, Mass.
5,912 to 5,916.—CARPETS.—R. R. Campbell, Lowell, Mass.
5,917.—CARD BASKET.—G. D. Dudley, Lowell, Mass.
5,918.—VASE.—N. L. Glauber, A. Schlank, New York city.
5,919.—CAMPAIGN BADGE.—E. W. Harrison, Jersey city, N. J.
5,921.—CARPET.—L. Jullien, Passy, France.
5,922.—CARPET.—C. S. Lilley, Lowell, Mass.
5,923.—CARPET.—D. McNair, Lowell, Mass.
5,924.—TRUNK CORNER CLAMP.—W. Bruen, Newark, N. J.
5,925.—BUCKET.—H. Everett, Philadelphia, Pa.
5,926.—PICKLE STAND AND BOTTLE.—G. Gill, Taunton, Mass.
5,927.—BADGE.—J. Hartman, Jr., Ormsby, Pa.
5,928.—FIREPLACE STOVE.—W. J. Keep, Troy, N. Y.
5,929.—HEATING STOVE.—W. J. Keep, Troy, N. Y.
5,930.—HEATING STOVE.—E. Mingay, Boston, Mass.
5,931.—TOY CARRIAGE BODY.—F. W. Porter, Springfield, Vt.
5,932.—OIL CLOTH.—V. E. Meyer, Lyon's Farms, Elizabeth, N. J.
5,933.—COOKING STOVE.—F. H. Root, Buffalo, N. Y.
5,934 and 5,935.—HOT AIR REGISTER.—E. A. Tuttle, New York city.
5,936.—STOVE.—N. S. Vedder, Troy, T. S. Heister, Lansingburgh, N. Y.

TRADE MARKS REGISTERED.

852.—WINES AND LIQUORS.—A. W. Balch & Co., New York city.
853.—PRESERVED FISH.—J. H. Dorsee, Islip, N. Y.
854 and 855.—BRANDY.—J. Hennessy & Co., Cognac, France.
856.—BISCUITS AND CRACKERS.—J. B. Kupfer, Kenosha, Wis.
857.—SALVE.—M. A. Paulin, Philadelphia, Pa.
858.—CRUSHED WHITE WHEAT.—F. E. Smith & Co., Brooklyn, N. Y.
859.—POLISH FOR METALS.—F. J. Tinkham, New York city.
860.—ELASTIC WEBBING.—J. Twamley, New York city.

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending, for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

15,696.—LINKS OF HORSE POWERS.—A. W. Gray. August 21, 1872.
21,352.—RAILROAD CAR SEATS.—C. M. Mann. August 14, 1872.
21,416.—COFFEE ROASTER.—T. Heermans. August 21, 1872.
21,436.—RAILROAD CAR COUCH.—F. R. Myers, F. H. Furniss.—August 21, 1872.
21,443.—MACHINE FOR TURNING HUBS.—A. Richart. August 21, 1872.
21,465.—SEWING MACHINE.—S. C. Blodgett. August 21, 1872.
21,474.—JOURNAL BOX.—H. H. Thayer. August 21, 1872.
21,541.—PIN STICKING MACHINE.—C. W. Van Vliet. August 28, 1872.
21,828.—FURNACE FOR TEMPERING STEEL.—P. G. Gardiner. October 2, 1872.

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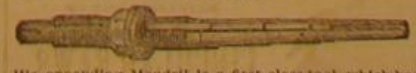

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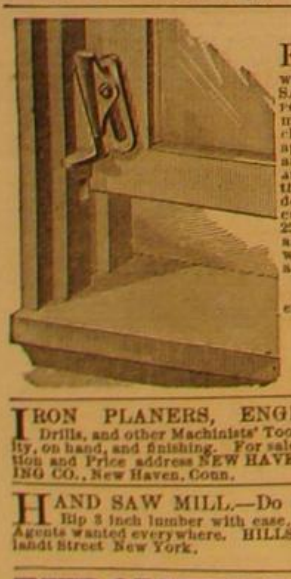

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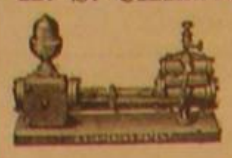

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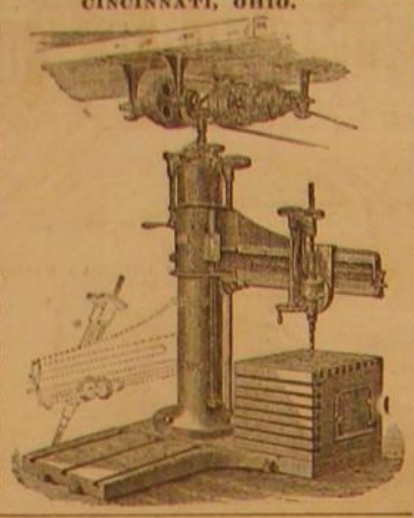

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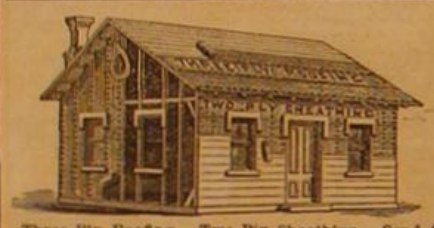

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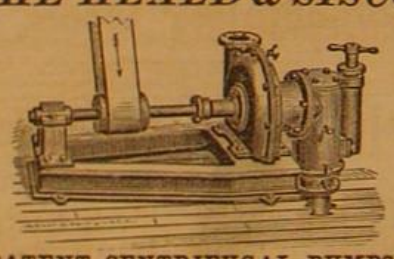

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